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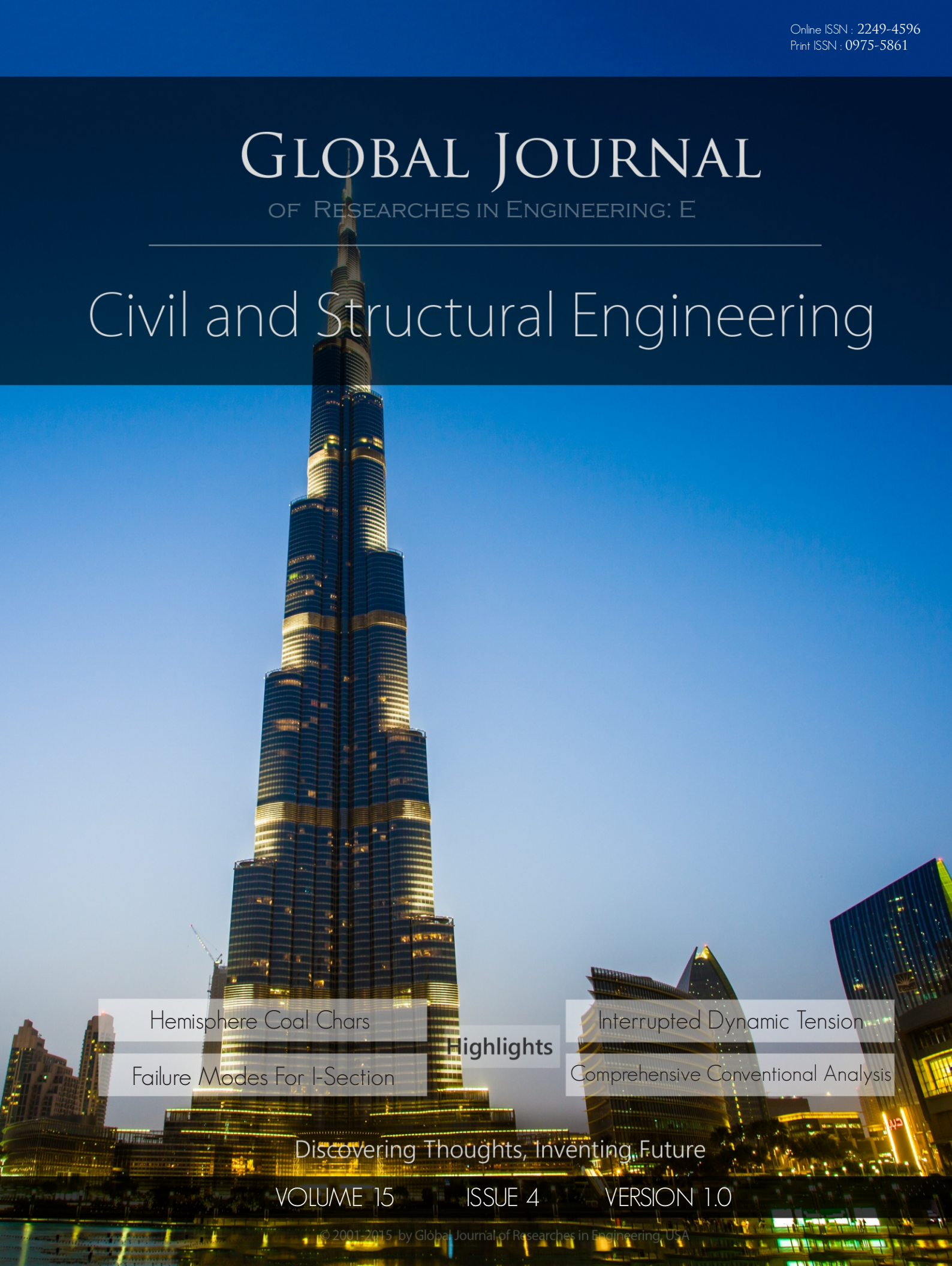

Hemisphere Coal Chars

Failure Modes For I-Section

Highlights

Interrupted Dynamic Tension

Comprehensive Conventional Analysis

Discovering Thoughts, Inventing Future

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Failure Modes for I-Section GFRP Beams

By Mamadou Konate & Zia Razzaq
Old Dominion University, United States

Abstract- This paper presents calculations for the failure modes for I-section Glass Fiber Reinforced Polymer (GFRP) beams with single mid-span web brace. Theoretical predictions are made using ASCE-LFRD Pre-Standard for FRP structures. For the member length considered, it is found that for small and medium I-sections the failure mode is governed by lateral-torsional buckling and for bigger I-sections the failure mode is governed by material rupture. The outcome of the predicted lateral-torsional buckling mode is compared with that observed experimentally.

Keywords: failure modes, I-section GFRP ASCE-LFRD standard for FRP structures.

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Mamadou Konate [α] & Zia Razzaq [σ]

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Keywords: failure modes, I-section GFRP ASCE-LFRD pre-standard for FRP structures.

I. Introduction

Razzaq, Z, Prabhakaran, R., and Sirjani, M. B [1] have conducted an experimental and theoretical study of the flexural-torsional behavior of reinforced beams using LFRD approach. The same authors have also provided a load and resistance factor design (LFRD) approach for fiber-reinforced plastic (FRP) [2]. The paper presents the outcome of a study on failure modes for I-section GFRP beams.

II. Experimental Study

A 93 inches long GFRP beam with a 8 x 4 x 0.5 in. is tested as shown in Figure 1.

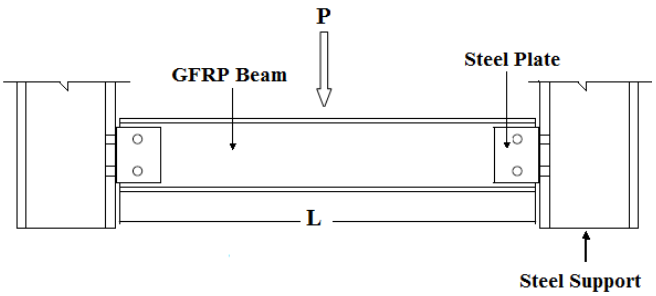

Fig. 1 : Schematic of I-Section GFRP beam

The test procedure involved applying the load, P, in small increments and recording the resulting deflections. Figure 2 shows the experimental test setup. In this figure, the ends have shear-type connections and a hydraulic jack of 50-kip capacity with load cell and a loading device are also shown.

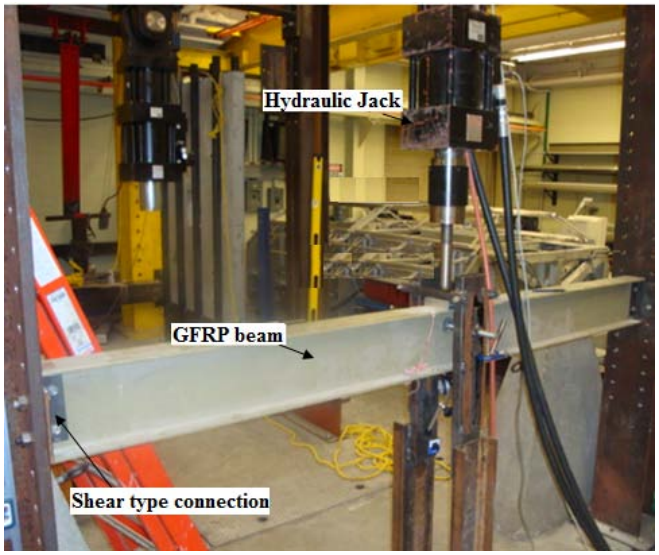

Fig. 2 : Test setup

Furthermore, bracing is provided at the mid-span on both sides of the web at 0.81 in. below the bottom surface of the top flange. It is observed that the tested GFRP beam first buckled and then cracked.

III. Basis For Predictions

The critical stresses are based on following ASCE-LRFD Pre-Standard formulae given in Reference 3:

$$f_{fcr} = \frac{4}{(\frac{b_f}{t_f})^2}\left(\frac{7}{12}\sqrt{\frac{E_{L,f}E_{T,f}}{1+4.1\xi}} + G_{LT}\right) \quad (1)$$

$$f_{wcr} = \frac{11.1\pi^2}{12(\frac{h}{t_w})^2}\left(1.25\sqrt{E_{L,w}E_{T,w}} + E_{T,w}v_{LT} + 2G_{LT}\right) \quad (2)$$

In Equations 1 and 2, f_{fcr} is the critical stress for the compression flange local buckling; f_{wcr} is the critical stress for the web local buckling; and the other terms are defined as:

G_{LT} = characteristic in-plane shear modulus, ksi
v_{LT} = characteristic longitudinal Poison's ratio
b_f = Full width of the flange, in.
h = Full height of the member, in.
t_f = Thickness of the flange, in.
t_w = Thickness of the web, in.
ξ = Coefficient of restraint
k_r = Rotational spring constant, kip/rad
$E_{L,f}$ = Characteristic longitudinal modulus of the flange, ksi

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$E_{L,w}$ = Characteristic longitudinal modulus of the web, ksi
$E_{T,f}$ = Characteristic transverse modulus of the flange, ksi
$E_{T,w}$ = Characteristic transverse modulus of the web, ksi

There are four nominal moments that are calculated next using the following formulae given in Reference 3:
Lateral-Torsional Buckling:

$$M_{LB} = C_b \sqrt{\frac{\pi^2 E_{L,f} I_y D_J}{L_b^2} + \frac{\pi^4 E_{L,f}^2 I_y C_w}{L_b^4}} \quad (3)$$

in which M_{LB} is the nominal flexural strength due to lateral-torsional buckling and the other terms are defined as follows:
C_b = Moment modification factor for unsupported spans with both ends braced
D_J = Torsional rigidity of an open section = $G_{LT} \sum \frac{1}{3} b_i t_i^3$, $kip - in.^2$
C_ω = Warping constant = $\frac{t_f h^2 b_f^3}{24}$, $in.^6$
Herein, the resistance factor $\phi = 0.7$ is used.
Local Instability:

$$M_{fLT} = f_{fcr} \frac{E_{L,f} I_f + E_{L,w} I_w}{y E_{L,f}} \quad (4\text{-a})$$

$$M_{wLT} = f_{wcr} \frac{E_{L,f} I_f + E_{L,w} I_w}{y E_{L,w}} \quad (4\text{-b})$$

In these equations, M_{fLT} and M_{wLT} are the nominal flexural strengths due to local instability in the flanges and webs, respectively; the other terms are defined as follows:
I_f = Moment of inertia of the flange(s) about the axis of bending, in^4.
I_w = Moment of Inertia of the web(s) about the axis of bending, in^4.
y = Distance from the neutral axis to the extreme fiber of the member, in. The resistance factor $\phi = 0.80$ is used.
Material Rupture:

$$M_{cr} = \min \left(\frac{F_{L,f} (E_{L,f} I_f + E_{L,w} I_w)}{y_f E_{L,f}}, \frac{F_{L,w} (E_{L,f} I_f + E_{L,w} I_w)}{y_w E_{L,w}} \right) \quad (5)$$

in which M_{cr} is the nominal flexural strength due to material rupture and the other terms are defined as follows:

$F_{L,f}$ = characteristic longitudinal strength of the flange (in tension or compression),ksi
$F_{L,w}$ = characteristic longitudinal strength of the web (in tension or compression),ksi
I_f = Moment of inertia of the flange(s) about the axis of bending, in^4.
I_w = Moment of inertia of the web(s) about the axis of bending, in^4.
y_f = Distance from the neutral axis to the extreme fiber of the flange, in.
y_w = Distance from the neutral axis to the extreme fiber of the web, in. The resistance factor $\phi = 0.65$ is used.

Lastly, applying the formula of maximum moment for a simply supported beam with a point load as shown in Figure 1, the respective loads are obtained:

$$P_{LT} = \frac{4M_{LT}}{L} \quad (6)$$

$$P_{fLT} = \frac{4Mf_{LT}}{L} \quad (7)$$

$$P_{wLT} = \frac{4Mw_{LT}}{L} \quad (8)$$

$$P_{cr} = \frac{4M_{cr}}{L} \quad (9)$$

In Equations 6 through 9, P_{LT}, P_{fLT}, P_{wLT}, and P_{cr} are the load-carrying capacities due to lateral-torsional buckling, local instability in the flanges, local instability in the webs, and material rupture, respectively.

If $P_{LB} = P_{fLT} = P_{wLT} = P_{cr} = P_c$ is the load-carrying capacity of the member, a LFRD approach is proposed as follows:

$$P_c = \phi P_n \quad (10)$$

where P_n is the minimum of the values obtained in Equations 6-9. The resistance factor $\phi = 0.7$, 0.8, and 0.65 depending whether the failure is due to lateral torsional buckling, local instability in the flanges or webs, and rupture of the materials, respectively. The beam design load is expressed as:

$$P_u = 1.2P_D + 1.6P_L \quad (11)$$

in which P_D and P_L are the dead and live loads for the beam. The proposed LFRD approach criterion for the member can finally be written as:

$$P_u \leq P_c \quad (12)$$

where P_u and P_c are defined in Equations 10 and 11, respectively. Table 1 shows the maximum loads for the following I-beams: 3x1x0.25 in., 6x3x0.375 in., 8x4x0.5 in., 10x5x0.375 in., and 12x6x0.5 in.

Table 1: Maximum loads for failure modes.

I -Section in.	ϕP_{LB} lbs	ϕP_{fLB} lbs	ϕP_{wLB} lbs	ϕP_{cr} lbs
3x1.5x0.25	170	2526	35389	8867
6x3x0.375	2041	8506	162479	4980
8x4x0.50	8026	20162	385136	11804
10x5x0.375	13581	15522	279162	13890
12x6x0.5	37399	20220	592231	26635

For 8 x 4 x 0.5 in., the experimental lateral-torsional buckling load is found to be 4.70% higher than the predicted result. However, the experimental cracking

load is 27.60% lower than the predicted result. As seen in Table 1, for the first three I-sections namely 3x1x0.25, 6x3x0.375, 8x4x0.50, the failure mode is governed by lateral-torsional buckling. However, for the last two I-sections namely 10x5x0.375 and 12x6x0.5, the failure mode is governed by material rupture.

IV. Conclusion

A study on failure modes for I-section GFRP beams is presented. The predicted buckling load for the GFRP beam is in agreement with the experimental value. Based on the analysis for the member length considered, the failure mode is governed by lateral-torsional buckling for smaller and medium cross sections. However, the material rupture governs the failure mode for the bigger sections.

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Comprehensive Conventional Analysis of Southern Hemisphere Coal Chars of Different Ranks for Fixed Bed Gasification

By Andrew O. Odeh
North-West University, South Africa

Abstract- In this study, the physical and chemical changes accompanied in the coal to char transition were examined by conventional and Fourier Transform infrared spectroscopy (FTIR) techniques. Six coals (lignite to anthracite) of ≤75 **μ**m were acid washed, and subjected to a slow heating rate of 20 °C/min from 450 to 700 °C at atmospheric atmosphere. The chars were characterized by physical, chemical and petrographic evaluations. The coals were low rank C lignite (Rov = 0.31), low rank B sub-bituminous (Rov = 0.47), medium rank C bituminous (Rov = 0.73 for high volatile and Rov = 0.78 for low volatile), high rank C semi-anthracite (Rov = 2.48) and high rank B anthracite (Rov = 3.26) respectively. Char properties determined by conventional technique (proximate, ultimate and calorific value) and FTIR revealed correlations of the chemical structural changes during the coal to char transition. Unique relationships between the fuel ratio and other coal properties (H/C atomic ratio and aromaticity) were established. The fuel ratio was determined to be in the range of 1.9 – 21.0 for lignite; 3.4 – 20.3 for sub-bituminous; 5.5 – 24.0 for bituminous; 11.6 – 29.6 for semi-anthracite and 16.5 – 27.8 for anthracite.

Keywords: *southern hemisphere coal; char transition; pyrolysis; fuel ratio; rank parameter; FTIR.*

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It was possible to find a first-order relationship between the char aromaticity and atomic H/C.

Keywords: southern hemisphere coal; char transition; pyrolysis; fuel ratio; rank parameter; FTIR.

I. Introduction

Pyrolysis remains an important process for thermo-chemical coal conversion either as an individual process for char and tar/oil production or as a step in other coal conversion processes such as combustion, gasification, and liquefaction. During fixed bed gasification, coal passes through four distinct stages: drying, pyrolysis, reduction, and combustion [1]. In the pyrolysis stage, volatiles devolatilization occurs and the properties transformation from coal to char can be dramatic for some coals. The behavior of coal under pyrolysis can be linked to coal properties and process conditions such as coal rank, particle size, porosity, surface area, mineral content, petrographic composition, process temperature, process pressure, catalyst, and heating rate [2 – 13]. Thus, among other aspects the time-temperature histories will have an influence on the char reactivity and behavior. The inorganic components are sometime responsible for poor and unstable performance of coal conversion processes [8, 14 - 17]. However, in other conversions, such as direct liquefaction the pyrite mineral is beneficial to the yield of the process [3, 12].

The atomic H/C, aromaticity, petrography, and fuel ratio (the ratio of fixed carbon to volatile matter content) influences on coal conversion processes have been investigated [18-33]. Char properties such atomic H/C ratio, aromaticity, morphology and fuel ratio has also received attention [8, 19, 25, 34 – 36]. However, a systematic evaluation for the transitions accompanying slow-heating rate using a temperature monitored process is limited [37-40]. Zhao et al. [37] examined the pyrolysis behaviour of vitrinite and inertinite extracts from a Chinese bituminous coal at temperatures of 400 to 650 °C and heating rate of 10 °C/min and reported that the atomic H/C ratio of both the vitrinite and inertinite char decreased with increasing temperature, and have similar atomic H/C ratio and structure characteristics at the final temperature. Guerrero et al. [38] performed combined reflectance analysis on heat-treated coal at temperatures of 400, 450, 550, 750, 1000 °C and reported the effect of volatiles release on the optical properties of macerals from different ranks The reflectance of coal macerals increases with increasing pyrolysis temperature, with temperature being the most relevant factor in determining the reflectance of inertinite macerals. The studies of Jimenez et al. [39] and Alonso et al. [40] both focused on the influence of process conditions on char optical texture and reactivity. They reported the influence of both pressure and temperature on the resultant chars. The coal char properties derived at 900 °C and heating rate of 20 °C/min, exhibited significant changes in reactivity in the pressure range 0.1 to 0.5 MPa, after which no significant changes were observed with pressure increment. Alonso et al. observed that the temperature of pyrolysis performed at temperatures of 1000 and 1300 °C had a strong effect on char reactivity, which was attributed to inertinite maceral in high rank coals yielding both more reactive and less reactive materials depending on the process conditions. Tracing char structure evolution during coal conversion process allows an improved evaluation of the conversion mechanism [38]. Of the many rank

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indicators and char properties the fuel ratio (a commonly used factor in the design of unit operations for coal conversion processes and also a useful parameter in the selection of coals used in coal blending plant) has not commonly evaluated but may prove to be useful indicator in the coal to char conversion process [3, 7]. Most power plants utilized coals with fuel ratio in the range of 1.0 - 2.5 due to their combustion characteristics of calorific values, ignitability, and combustibility [4, 7, 33]. Fuel ratio is considered to give an indication of coal reactivity as coals with fuel < 1.5 are thought to combust more smoothly whereas coal with fuel ratio > 1.5 combust with difficulty [2, 4, 31]. Kurose et al. [4] examined the pulverized coal combustion characteristics of high-fuel-ratio coals with fuel ratio in the range of 1.46 to 7.10 and concluded that as the fuel ratio increases, nitrogen oxides (NO_x) emission reduces significantly and that the char's external surface area decreases with increase in the fuel ratio of the coal. Fuel ratio of acid washed and slow-heating coals are not readily available. Thus the fuel ratio is a somewhat forgotten rank parameter that may have utility in coal to char transitions.

Here the chemical and structural changes accompanying coal pyrolysis performed on a 75 μm size, at a heating rate of 20 °C/min from 450 to 700 °C at atmospheric pressure. The changes in the char structure were traced and relationship between char formation process indices and coal/char properties are established. The selected coals were acid washed to reduce mineral matter and ash influences.

II. Experimental

a) Sample Preparation

Six coals of varying rank were used: a lignite coal from Germany (LIG); a sub-bituminous coal from Nigeria (SUB); two South African bituminous coals (one is low volatile bituminous (BIT-LV) and the other, high volatile bituminous coal (BIT-HV); South African semi-anthracite (SA); and anthracite from South Africa (ANT). The coal samples were pulverized to coal particle size of ≤ 75 μm by employing a mechanical size reduction jaw crusher (Samuel Osborne (SA) LTD, model: 66YROLL) and a Fritsch P-14 rotary mill containing ceramic balls (Model number: 46 – 126). The required particle size of -75 μm was finally obtained from screening the particles from the rotary mill using a 75 μm screen All the samples were stored under argon in sealed bags.

The prepared coal samples were acid washed by sequential leaching with hydrofluoric acid (HF) and hydrochloric acid (HCl) as detailed in Strydom et al. [17].The HF (48%) and HCl (32%) were obtained from Associated Chemical Enterprise (ACE), South Africa.

b) Apparatus and procedure

The coal samples (40g) were placed in a ceramic boat in a horizontal tube furnace at atmospheric conditions initially. The samples were flushed with nitrogen (AFROX, ultra high purity grade) at atmospheric conditions, to remove oxygen from the oven for 15 min. at a flow rate of 1 litre/min. The furnace was then heated at 20 °C/min to the target temperature, and held isothermally for 60 minutes. The target temperature ranged from 450 to 700 °C, while keeping the samples under a nitrogen atmosphere. The char samples were stored in sealed bags.

The calorific value and conventional chemical analyses (proximate and ultimate analyses) of the untreated coal, acid treated and heat treated samples were performed according to the ISO 1928, ASTM 3172 and ASTM 3176 standards respectively at Advanced Coal Technology (ACT), Pretoria, South Africa. The surface areas of the various samples were determined using the carbon dioxide adsorption BET method on a Micromeritics ASAP2020 surface area analyser [41]. Prior to CO_2 adsorption, the samples (about 0.20 g) were degassed under vacuum (10.0 μmHg), for 48 hours at 25 and 380 °C for the coals and chars respectively. The evacuated sample was analysed at 0 °C in an ice bath. The results were processed using the Accelerated Surface Area and Porosimetry System (ASAP) 2020 software linked to the Surface Area Analyzer. The spectra used in obtaining the structural properties of both the coal and char were obtained from the Fourier-transform infrared spectrometer equipped with an attenuated total reflectance (FTIR-ATR), model Perkin-Elmer Spectrum 400. The procedure of FTIR-ATR as detailed by Li et al. was used [42]. Aromaticity (f_a) was obtained from the ratio of aromatic bands in the 900 – 700 cm^{-1} region to the aliphatic and aromatic bands in the 3000 – 2815 cm^{-1} region [43]. The vitrinite reflectance of the parent coal was obtained following the procedure and equipment at the coal and carbon laboratory, University of the Witwatersrand, South Africa as detailed in Malumbazo et al. [29].

III. Results and Discussion

Chemical analysis for the parent coal are summarized in Table 1, where coals are listed by increasing rank (lignite to anthracite) as determined by vitrinite reflectance analysis [29]. The rank parameters follow the expected trend with increasing rank, a decrease in volatile matter, hydrogen content, oxygen content, atomic O/C ratio and atomic H/C ratio, and an increase in carbon content, fuel ratio, and aromaticity [8 – 9, 12 – 15, 18 – 22, 54 – 55]. The atomic ratio of hydrogen to carbon (H/C) increases as the coal rank decreases with lignite coal sample having the highest ratio of 1.12 and the anthracite coal has the lowest

value of 0.36. A similar trend was obtained for the atomic O/C ratio with the lignite coal having a value of 0.20 and the anthracite coal, 0.02. The values obtained in this study compare well with those of Ibarra et al. [18], who reported values ranging from 1.27 for peat to 0.17 for anthracite for the atomic H/C ratio and 0.43 for peat and 0.06 for anthracite. The aromaticity shows a trend of increasing values with increasing coal rank with the lignite coal having a value of 0.38 and the anthracite a value of 0.97 [17 – 18, 25]. A similar trend was obtained for the calorific value with the lignite having a value of 21.2 MJ/kg and the anthracite a value of 29.6 MJ/kg. Typically there is a slight drop in the calorific value between the low rank and high rank coals. The fuel ratio ranges from 0.6 for the lignite coal to 16 for the anthracite coal. There was good agreement with the aromaticity, calorific value, and fuel ratio of the bituminous coals (BIT-LV and BIT-HV) with those reported by Everson et al. for typical South African bituminous coals [25].

The lignite coal has a mean random vitrinite reflectance of 0.35 representing a low rank C coal (Table 1). The mean random vitrinite reflectance obtained for the sub-bituminous coal in this study was 0.47 characterised as low rank B coal; for the bituminous coals, the values determined are 0.73 and 0.78 for BIT-LV and BIT-HV characterised as medium rank C coals. The high rank coals SA and ANT have values of 2.48 and 3.26 thus high rank C and high rank B coals respectively [28 - 29].

The chemical analyses of the acid-washed coal are presented in Table 2. The differences observed between parent and acid washed coal was significant. A similar trend was observed for the acid washed coals as was with the parent coals. Observations of increased surface area with coal rank for acid cleaned were also reported by Kister et al. [12] The increased volatile matter as a result acid washing was expected to have increased the surface area and porosity of the coals due to the opening of pores, which were blocked by mineral impurities, but that was not the case with lower rank coals that experienced higher percentage increase in volatile matter content [12]. However, that was not observed for the low-rank coals where the surface area was reduced or unchanged. Mahajan and Walker [16] also observed a reduction in surface area for some coals, attributed to mineral precipitation or blocking of pores. This finding of insignificant change in aromaticity was reported by the work of Strydom et al. [17], who reported no change in the aromaticity of the demineralized coals when compared to the raw bituminous coals, and by the work of Ishihara et al. [33], who investigated the effect of demineralization on hydrogen transfer of coal with tritiated gaseous hydrogen. They revealed that demineralization does not affect the amounts of functional groups in the parent coals of different ranks ranged from lignite to low volatile bituminous coal. Here, the atomic H/C was not significantly changed and the O/C was relatively constant after the acid wash. This is similar to the observations of Strydom et al. [17] and Kister et al. [12].

Table 3 shows the atomic H/C ratio decreases with increasing char formation temperature. At temperature of 700 °C, there was a convergence to the value of 0.13 which was also observed by Zhao et al. [37]. As can be seen in Table 3, the O/C atomic ratio decreases with increasing char formation temperature for all the coals apart from anthracite with constant value of 0.03 for the temperature range of 450 – 700 °C. The uniform value obtained for the anthracite can be explained by variation in petrographic composition (data not included in this paper). The anthracite may be considered as a typical South African high-inertinite content coal. The aromaticities show an increasing trend with increasing char formation temperature (Table 3). For instance, Everson et al. [25] had similar aromaticities and trends for raw and acid-washed chars heat treated in a similar range (550 to 850 °C).

The fuel ratio data is given in Table 3. The fuel ratio increases with increase in the char formation temperature process. Though slight differences can be observed in the values obtained for the parent coal and the acid washed coals, the impart is more significant in the heat treated coal and a convergence occur around 700 °C especially for the low and medium ranks (Table 3). During the char formation process in the temperature 450 – 700°C, devolatilization, aromatization, and arrangement of the basic structural units (BSUs) are likely to have occurred as there were significant transformational changes in aromaticity, fuel ratio, H/C and O/C obtained. The pattern of these transformations in aromaticity, fuel ratio and H/C was consistent for all coal chars: lignite to anthracite. The H/C values decreases with increase in the heating temperature while the aromaticity and fuel ratio increases with increase in heating temperature as seen in Figure 1. This is attributed to the chemical modification (devolatilization, removal of aliphatic groups and heteroatoms) that occurs during carbonization that results in the ordering of the internal structure of the samples [25, 43 – 45]. From these parameters it can be observed that coal increases its aromaticity and fuel ratio with increasing char formation temperature. Aromaticity and atomic H/C ratio are in use as reference indicators in coal conversion processes. It is suggested that fuel ratio has similar utility.

To establish a relationship between the determined aromaticity, fuel ratio and H/C ratio during the char formation temperatures of 450 – 700 °C; figures of the transitional relationships with

temperature, aromaticity with atomic H/C, fuel ratio versus aromaticity, fuel ratio versus H/C were constructed (Fig. 1 - 7). In Fig. 1, the changes in fuel ratio, aromaticity and atomic H/C of the parent coals are compared with the chars obtained at increasing char formation temperature. The fractional increase in the fuel ratio was more pronounced in the low and medium ranks with increasing char formation temperature as expected. The same trend was observed for the aromaticity, whereas, for the atomic H/C, fractional decrease was observed. Fig. 2 and 3 reveals the relationship between the aromaticity and atomic H/C ratio. The correlation between the aromaticity and H/C ratio gave a linear relationship (Fig.2), whereas for the coal char, the relationship obtained was dependent on the coal rank (Fig.3). These results are consistent with the general trends reported in previous studies for raw bituminous coal but the extension of these correlations to interpret the structural transformation of other coal rank remain a subject of controversy [46 -49]. Whereas the correlation obtained in this study is dependent on coal rank and could be used for the interpretation of the relationship between aromaticity and atomic H/C structural changes (Fig. 3). Fig.4 demonstrates the correlation between aromaticity and fuel ratio with increasing char formation temperature, which follows same trend for all coal ranks apart from the low rank coals with little degree of deviation from the trend. This deviation could be attributed to the higher percentage of oxygen and oxygen containing functional groups in the low rank coals (LIG and SUB). It is known the low-rank coals have limited thermoplastic ability and hence do not undergo as extensive an ordering as bituminous coals The two low-rank coals do not align and coalesce to the same degree resulting in a lower aromaticity. These results of increasing aromaticity with increasing char formation temperature are consistent with the general trend reported in previous charring studies on raw coal in respect of increasing aromaticity with decreasing coal reactivity [50]; increasing aromatic condensation [51]; less ordered material [52]; increasing reflectance [32]; and increasing optical texture [38]. Fig.5 presents the variation of fuel ratio with atomic H/C. With increasing fuel ratio with the char formation temperature, there is a corresponding decrease in the atomic H/C with a convergence to the same value of 0.13 at the final char formation temperature of 700 °C. The fuel ratio for the two low rank coals were close with similar devolatilization behavior, the two bituminous coals with close fuel ratio values have a similar devolatilization behavior, while the two high rank coals behave in like manners when subjected to heat treatment.

Table 3 also shows the surface area decreasing with increasing rank in the char formation process. Figs. 6 indicates the variation of the BET surface area with the atomic O/C (lignite coal is used as an example for illustration) and % change in BET surface area with % change in oxygen (daf). The variation in atomic O/C and % change in oxygen and compared to the raw coal is more pronounced in the low rank coals, due to higher oxygen content and of oxygen-containing functional groups such as carboxylic and phenolic [19, 53-54]. Coal particles undergo thermo-chemical decomposition with release of volatile will often increase in the porosity and surface area of the resultant char [52, 55-57]. The relationship in Fig. 6 showed that for every decrease in the atomic O/C, there is a corresponding increase in the surface area during the char formation process. It is generally known that the diffusion of oxygen to and within the char particle influences the rate of char burning and resulting transitions in char morphology (Fig.5.) [19, 40, 58–59].

Table 1: Proximate analysis, ultimate analysis, calorific values, aromaticity, BET surface area, vitrinite reflectance and calculated H/C and fuel ratio values for untreated coal

Coal	LIG	SUB	BIT-LV	BIT-HV	SA	ANT
Inherent moisture(air dried) wt.%	15.4	9.6	4.2	2.1	1.0	1.5
Ash (air-dried) wt.%	12.4	9.0	29.1	16.2	17.3	11.2
Volatile matter (air-dried) wt.%	45.7	37.6	21.4	26.7	7.6	5.3
Fixed carbon (air-dried) wt.%	26.4	43.8	45.3	55.0	74.1	82.0
Carbon (daf) wt.%	70.5	75.6	77.5	81.6	90.4	90.2
Hydrogen (daf) wt.%	6.6	5.2	4.5	4.6	3.5	2.7
Nitrogen (daf) wt.%	0.6	1.7	2.2	2.0	2.0	2.2
Oxygen (daf) wt.%	18.5	16.9	15.4	10.7	3.3	2.7
Sulphur (daf) wt.%	3.7	0.7	0.4	1.2	0.9	2.3
Gross calorific value (MJ/kg) (air-dried)	21.2	24.6	20.0	26.8	28.7	29.6
H/C (daf).	1.12	0.82	0.69	0.67	0.46	0.36
O/C (daf)	0.20	0.17	0.15	0.10	0.03	0.02
f_a	0.38	0.57	0.70	0.71	0.91	0.97
Fuel ratio	0.6	1.2	2.1	2.1	10	16
CO_2 BET surface area (m^2/g)	74	104	95	84	108	122
Rank (mean random vitrinite reflectance %)	0.31	0.47	0.78	0.73	2.48	3.26

Table 2 : Proximate analysis, ultimate analysis, calorific values, aromaticity, BET surface area and calculated H/C and fuel ratio values for acid – washed coal

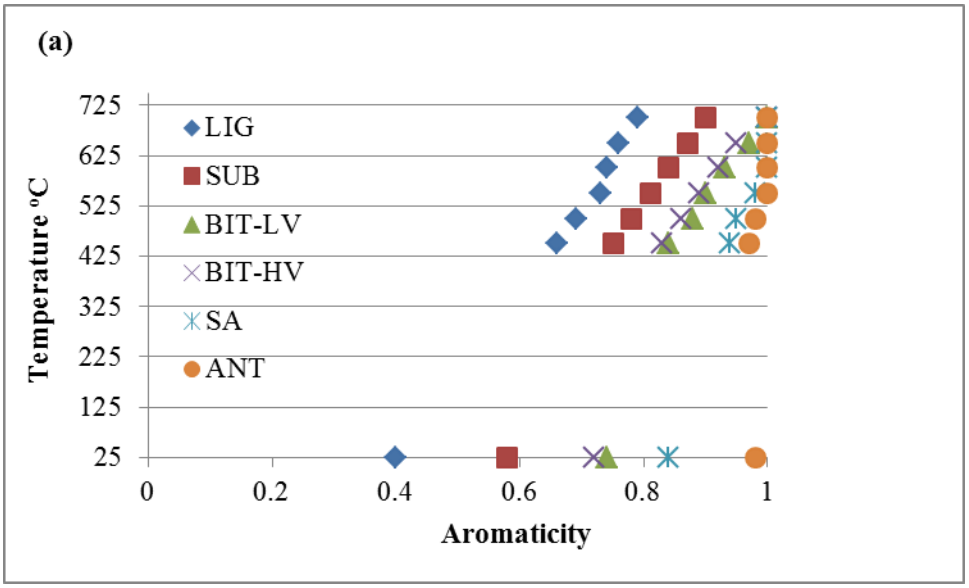
Coal	LIG	SUB	BIT-LV	BIT-HV	SA	ANT
Inherent moisture(air dried) wt.%	1.7	1.9	1.3	2.7	2.3	2.5
Ash (air-dried) wt.%	0.8	2.0	3.3	1.2	1.8	1.5
Volatile matter (air-dried) wt.%	60.3	43.2	25.0	27.2	9.6	6.8
Fixed carbon (air-dried) wt.%	37.3	53.0	70.4	68.9	86.3	89.2
Carbon (daf) wt.%	69.2	75.1	80.9	83.4	89.0	85.6
Hydrogen (daf) wt.%	6.2	5.2	4.2	4.6	3.3	2.4
Nitrogen (daf) wt.%	0.6	1.8	2.3	2.0	1.8	2.0
Oxygen (daf) wt.%	20.3	17.4	12.3	9.1	5.0	7.7
Sulphur (daf) wt.%	2.7	0.1	0.3	1.0	0.7	2.1
Gross calorific value (MJ/kg) (air-dried)	28.9	29.3	30.0	32.0	33.3	32.7
H/C (daf)	1.08	0.83	0.62	0.66	0.45	0.34
O/C (daf)	0.22	0.17	0.11	0.08	0.04	0.07
fa	0.40	0.58	0.74	0.72	0.84	0.98
Fuel ratio	0.6	1.2	2.8	2.5	9.0	13.0
CO2 BET surface area (m2/g)	74	94	111	95	125	138

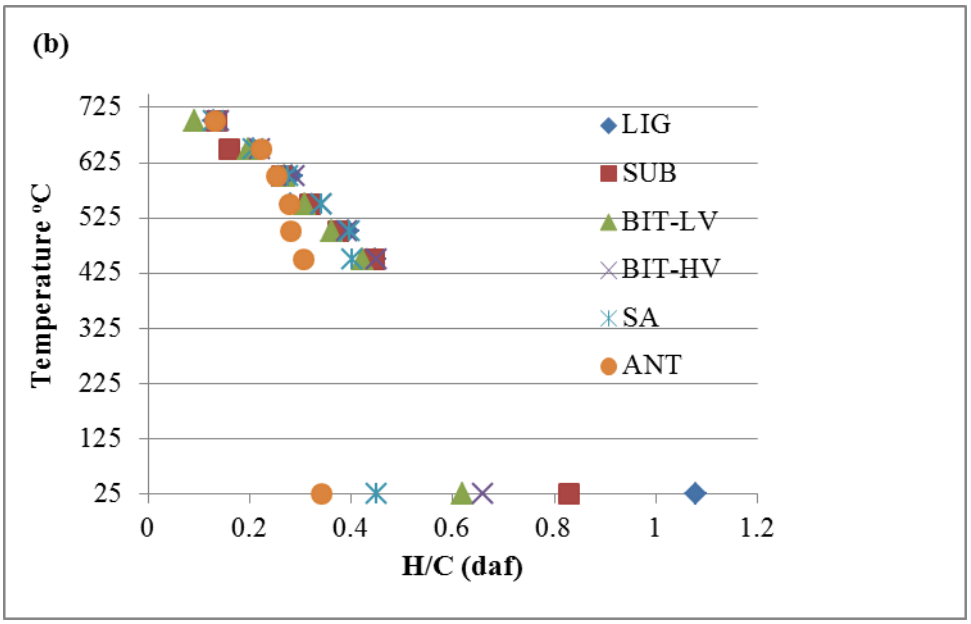
Table 3: Proximate analysis, ultimate analysis, calorific values, aromaticity, BET surface area and calculated H/C and fuel ratio values for heat – treated coal

CHAR	Wt % (air dried)				Wt % (daf)					daf	daf			m^2/g
LIG	Mois.	Ash	V.M	F.C	C	H	N	O	S	O/C	H/C	f_a	FR	BET
450	2.8	1.5	32.6	63.0	82.9	3.1	1.0	10.4	2.5	0.10	0.45	0.66	1.9	170
500	2.5	1.7	29.8	66.0	85.1	2.8	1.0	8.4	2.6	0.08	0.40	0.69	2.2	194
550	2.4	1.7	22.3	73.6	88.9	2.1	1.0	5.8	2.3	0.05	0.28	0.73	2.3	230
600	2.1	1.8	9.8	86.2	90.4	2.1	1.1	4.1	2.3	0.04	0.28	0.74	8.8	242
650	2.5	1.8	6.7	89.0	91.8	1.6	1.1	3.3	2.3	0.03	0.21	0.76	13.3	263
700	3.1	2.4	4.3	90.1	93.1	1.0	1.0	2.6	2.3	0.01	0.13	0.79	21.0	269
SUB														
450	3.2	2.7	24.2	69.9	84.9	3.2	2.2	9.2	0.5	0.08	0.45	0.75	2.9	156
500	3.1	2.3	22.5	72.1	87.3	2.7	2.3	7.2	0.5	0.06	0.38	0.78	3.2	183
550	3.0	1.9	21.7	73.3	89.7	2.4	2.3	5.1	0.5	0.05	0.32	0.81	3.4	184
600	3.2	2.4	13.3	81.1	91.3	2.0	2.3	4.1	0.5	0.04	0.26	0.84	6.1	234
650	3.6	2.5	8.8	85.1	92.0	1.5	2.2	3.9	0.5	0.03	0.16	0.87	9.7	238
700	4.0	2.5	4.4	89.1	93.1	1.0	2.0	3.4	0.5	0.03	0.13	0.90	20.3	240
BIT- LV														
450	1.5	3.6	14.6	80.3	88.1	3.1	2.1	6.4	0.4	0.06	0.42	0.84	5.5	137
500	1.3	3.7	12.5	82.5	89.7	2.7	2.2	5.1	0.3	0.05	0.36	0.88	6.6	154
550	1.0	3.6	9.5	85.9	89.7	2.3	2.1	5.5	0.3	0.05	0.31	0.90	9.0	199
600	0.8	3.6	7.7	87.9	89.6	2.0	2.1	5.5	0.3	0.05	0.27	0.93	11.4	200
650	0.8	4.1	5.5	89.6	91.7	1.5	2.1	4.3	0.3	0.04	0.20	0.97	16.3	215
700	1.0	4.2	3.8	91.0	92.6	0.7	2.3	4.1	0.3	0.03	0.09	1.00	24.0	224
BIT- HV														
450	0.9	1.3	13.9	84.0	88.1	3.3	2.1	5.7	0.8	0.05	0.45	0.83	6.0	130
500	1.1	1.1	11.4	86.4	89.0	2.9	2.1	5.4	0.7	0.04	0.39	0.86	7.6	159
550	0.9	0.9	8.6	89.6	91.3	2.6	2.2	3.4	0.5	0.03	0.34	0.89	10.2	184
600	0.9	1.1	7.3	90.7	92.1	2.2	2.1	3.1	0.5	0.03	0.29	0.92	12.4	206
650	0.9	1.2	5.0	92.9	93.1	1.7	2.1	2.5	0.6	0.02	0.22	0.95	18.6	215
700	0.9	1.1	3.9	94.1	95.5	1.1	2.0	0.9	0.6	0.01	0.14	1.00	24.1	225
SA														
450	0.6	1.5	7.8	90.1	89.5	3.0	1.9	4.8	0.8	0.04	0.40	0.94	11.6	138
500	0.7	1.6	6.6	91.1	90.8	3.0	1.8	7.9	0.8	0.07	0.40	0.95	13.8	148
550	0.5	1.2	5.7	92.6	91.4	2.6	2.0	3.2	0.8	0.03	0.34	0.98	16.2	170
600	0.5	1.0	4.8	93.7	91.4	2.1	1.9	3.8	0.8	0.03	0.28	1.00	19.5	187
650	1.2	1.3	3.7	93.8	92.5	1.6	1.9	3.1	0.8	0.03	0.21	1.00	25.4	195
700	0.9	1.3	3.2	94.6	92.9	1.0	1.9	3.4	0.8	0.03	0.13	1.00	29.6	197

ANT														
450	0.9	1.3	5.6	92.2	90.0	2.3	2.1	3.6	2.0	0.03	0.31	0.97	16.5	114
500	0.8	4.9	5.3	89.0	89.9	2.1	2.1	3.8	2.0	0.03	0.28	0.98	16.8	135
550	0.7	8.1	4.4	86.8	90.6	2.1	2.1	3.0	2.1	0.03	0.28	1.00	19.7	137
600	0.7	3.4	4.5	91.4	90.4	1.9	2.1	3.6	2.0	0.03	0.25	1.00	20.3	151
650	0.8	1.4	6.3	91.5	91.3	1.7	2.1	3.0	2.0	0.03	0.22	1.00	24.5	163
700	0.7	1.4	3.4	94.5	91.4	1.0	2.1	3.5	2.0	0.03	0.13	1.00	27.8	164

F.C fixed carbon; V.M. volatile matter; GCV gross calorific value; f_a aromaticity; FR fuel ratio; BET BET surface area.





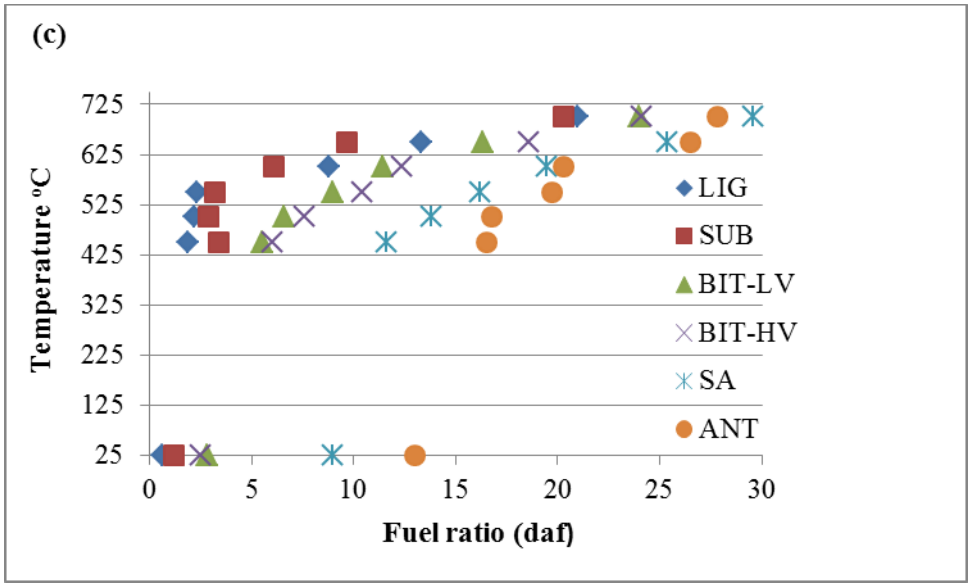


Fig. 1 : Transitional relationship between (a) Aromaticity; (b) H/C; (c) Fuel ratio with char formation temperature

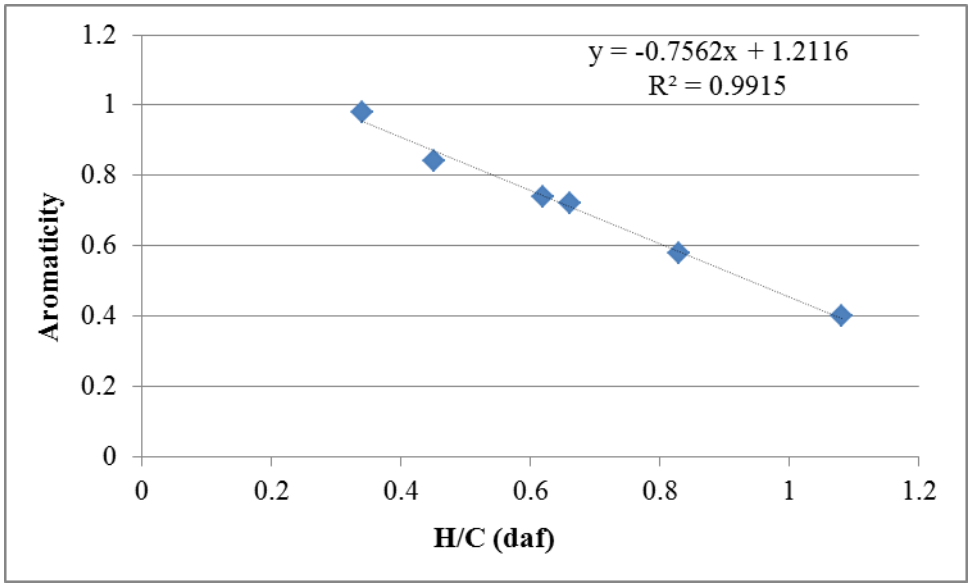


Fig. 2 : Relationship between the aromaticity and atomic H/C for the different coals

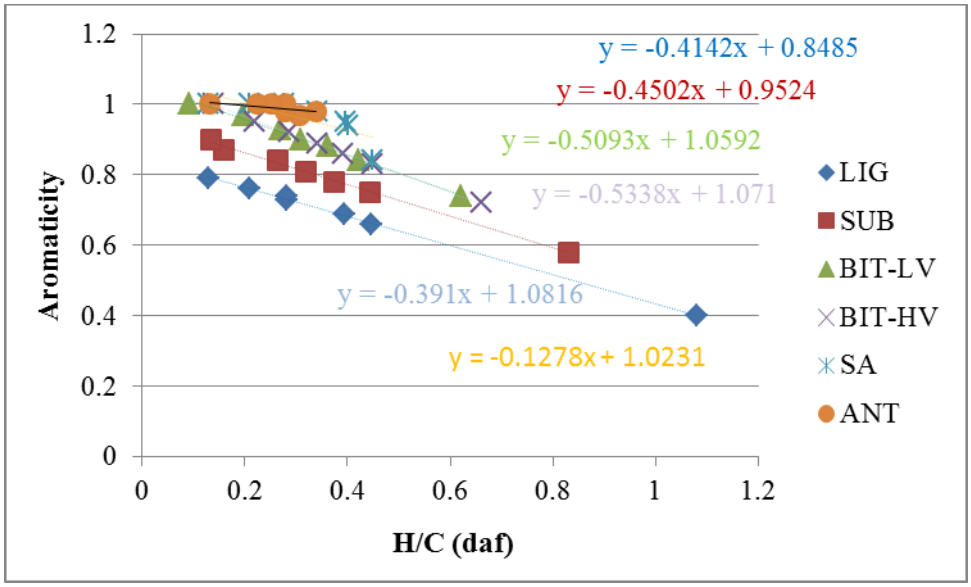


Fig. 3 : Relationship between the aromaticity and atomic H/C during pyrolysis

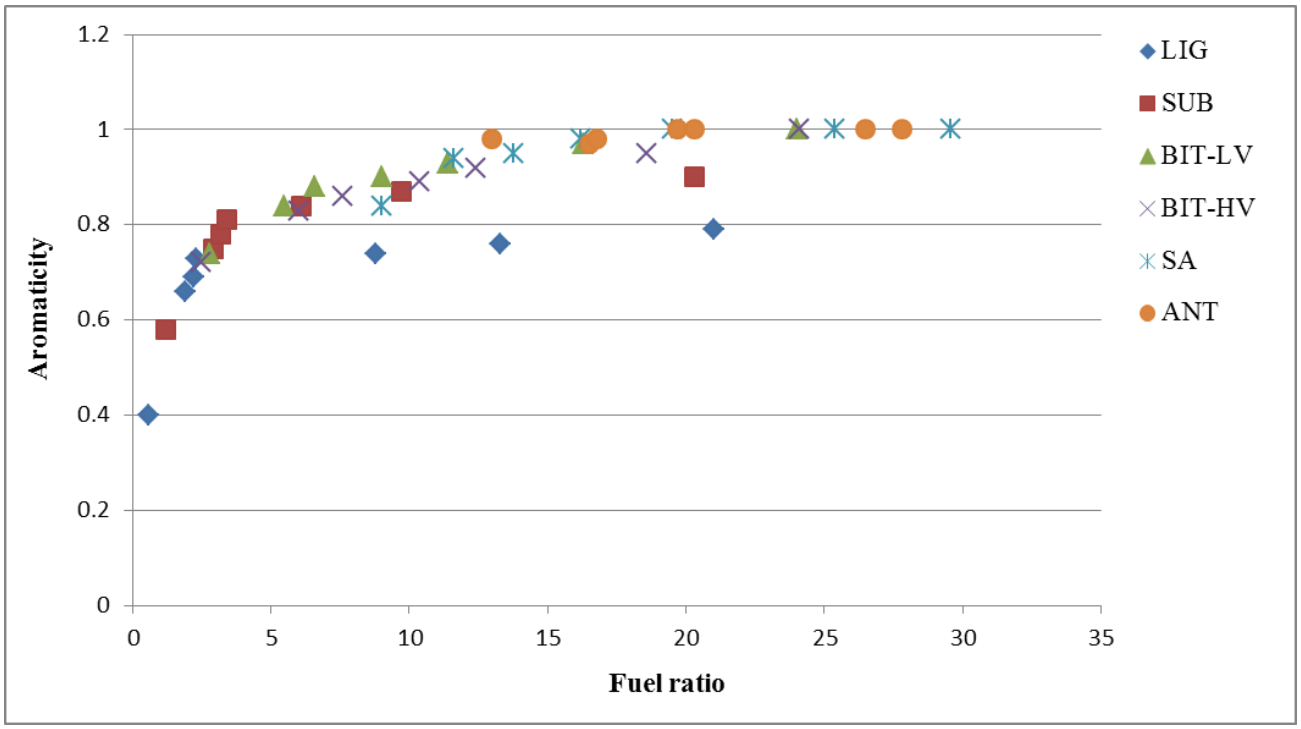


Fig. 4 : Transitional relationship between Aromaticity with Fuel ratio during pyrolysis

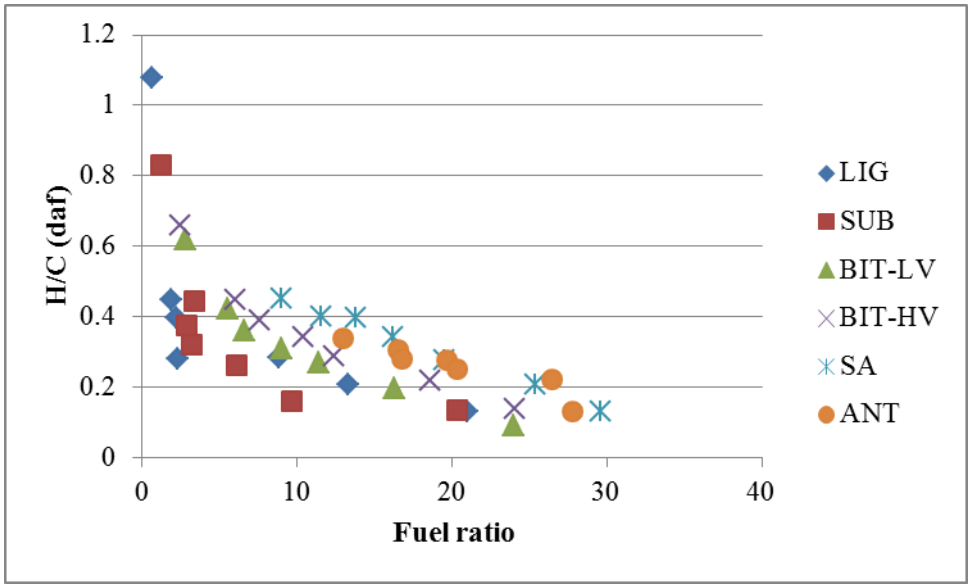


Fig. 5 : Transitional relationship between H/C and Fuel ratio during pyrolysis

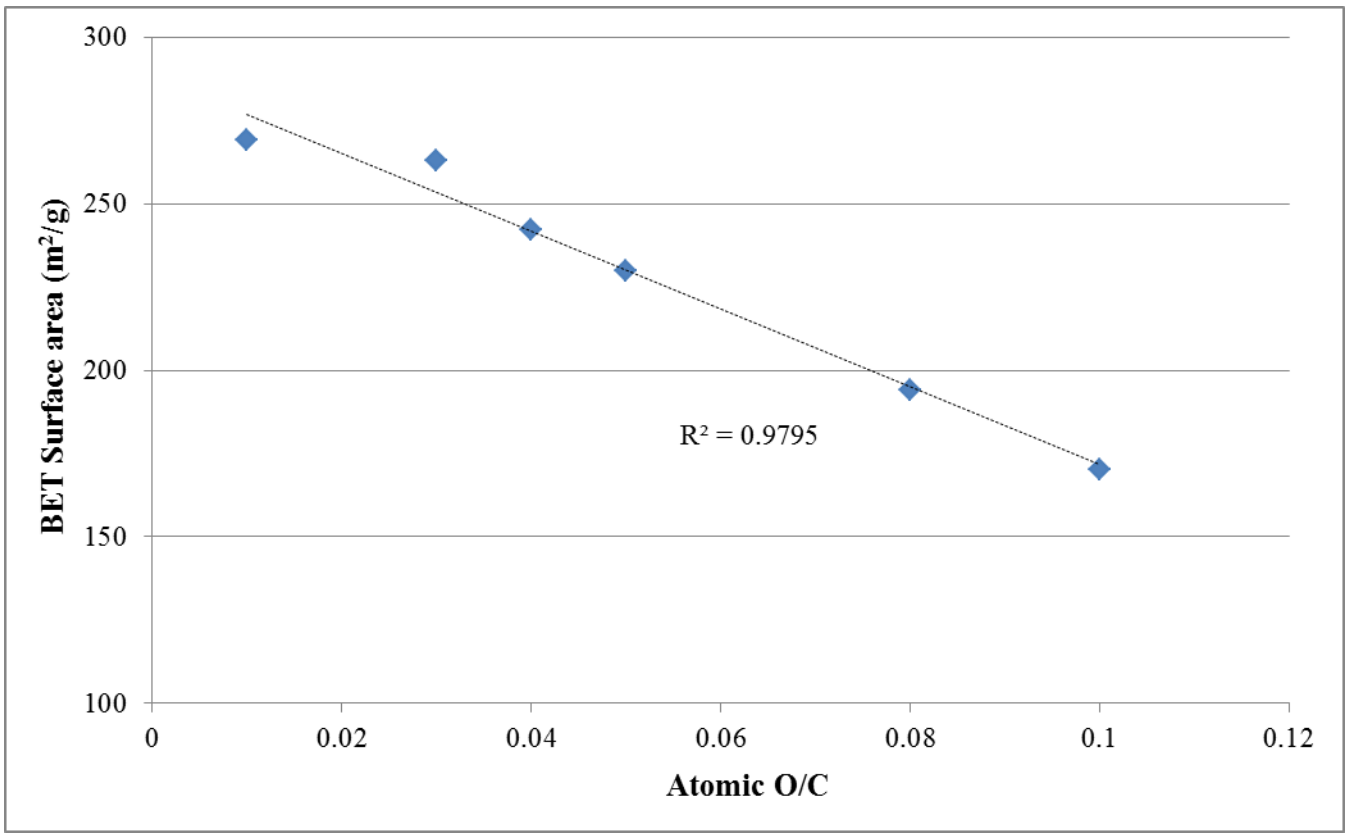


Fig. 6 : Variation of BET surface area with atomic O/C for the different acid-washed chars (450-700 °C)

IV. Conclusion

Though previous research have reported the characterization of coal and the subsequent chars, analysis on the transition stage with emphasis on the organic component only have not been adequately investigated. This study entailed the characterization of coal and chars of different ranks using both conventional and FTIR technique. It can be concluded that all different rank of coals show a similar behaviour in char properties, when subjected to elevated temperatures. The volatile matter, hydrogen, oxygen, atomic O/C ratio and atomic H/C ratio, decrease with temperature, while the carbon, surface area, calorific

value, fuel ratio and aromaticity increase with charring temperature, with the low rank coals (LIG and SUB) showing larger fractional structural changes. The crystallite structure order here as measured by aromaticity for the acid washed coal chars increases slightly with increase in heat treatment temperature for the higher rank coals. Regardless of the rank, all the acid washed coal chars become increasingly similar in atomic H/C at 700°C. The same trend was revealed in the aromaticity for the medium to high rank coals at temperature of 700 °C. The data generated for the fuel ratio (1.9 – 21.0 for LIG; 2.9 – 20.3 for SUB; 5.5 – 24.0 for BIT-LV; 6.0 – 24.1 for BIT-HV; 11.6 – 29.6 for SA and 16.5 – 27.8 for ANT, respectively), may be considered as a useful resource in coal processing data base. Therefore, I suggest the fuel ratio as a somewhat forgotten rank parameter that has utility in char formation work to be reconsidered for this purpose. Finally, it was possible to find a linear relationship between the coal char aromaticity and atomic H/C.

V. Acknowledgement

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Influence of the Projectile's Length on Interrupted Dynamic Tension Experiment Results

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Abstract- The main focus of this work is to discuss the influence of the projectile's length on the results of a Split Hopkinson Tension Bar (SHTB) experiment. By using the commercial software ABAQUS, finite element simulations of high-strain-rate tension experiments are accomplished on Aluminium 7017-T73 alloy specimens when varying the length of the projectile employed. The finite element analyses described herein are applied to simulate the effects of the variation of the projectile's length on the measurements obtained in the incident, reflected, and transmission bars. Different strain rates are obtained when varying the projectile's length always provided that its speed remains constant. The simulation results show that the projectile's length has a significant effect on the strain obtained in the specimen and also on the subsequent stress-strain curve of the specimen. In view of this research, it can be concluded that the projectile's length is a factor that can resolutely influence the interrupted dynamic tension experiment results since it has a significant effect on the strain obtained within the specimen. The simulations also provide complementary information to the experiments and an in-depth understanding of the specimen's behaviour.

Keywords: tension experiment, high-strain-rate testing, stress–strain curve, finite element method, split hopkinson tension bar, mechanical characterization.

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I. Introduction

Several techniques have been widely implemented in characterizing the high-strain-rate mechanical behaviour of engineering materials in order to optimize their use. The most common method for determining such dynamic behaviour is the Split Hopkinson Bar, which can be used both in tension (SHTB) and compression (SHCB). The Split Hopkinson Bar is used to test materials at strain rates as high as 10^4 s^{-1}. Simultaneously, damage evaluation and safety assessment of the integrity of structural elements under dynamic loading have recently drawn the attention of researchers. In this field, material dynamic response and dynamic constitutive material models are still necessary. The dynamic behaviour of materials studies have become increasingly relevant to many technological applications, such as those of Aeronautics, in which structural elements may undergo impacts due to the vulnerability of satellites and spacecrafts to collisions with space debris. It is also crucial in the Transportation Industry, in which under the hardest working conditions there is insufficient time for stress equilibrium to be achieved within the materials employed. Finally, it is also relevant in Ballistics, where modeling of armour panels under projectile impacts must become accurate.Quasi-static loading is applied so slowly that materials deform at a very low strain rate and therefore the inertia forces can be ignored. On the contrary, in a dynamic loading, impact involves a load which is quickly applied over a short time duration and therefore the inertia forces must be definitely considered. Whereas a quasi-static test can be interrupted at any time to study the microstructure of the material under a determined strain level, interrupting a dynamic test becomes an arduous issue.Therefore, the main focus of this work is to study the behaviour of materials under high strain rates and develop a tool which permits the materials being tested to undergo different levels of strain and strain rates in a controlled manner. In order to meet such requirements, the below-referred setup relevant to the viability of a SHTB model has been accomplished:

1. Finite element simulation of high-strain-rate tension experiments using different strain rates and projectile's lengths.
2. Comparison of the stresses and strains obtained at a determined strain rate and study of the influence of the projectile's length on the interrupted dynamic tension experiment results.
3. Design of a SHTB model when using an Aluminium 7017-T73 alloy in which the effect of the projectile's length can be taken into account.

II. Experimental Apparatus

The SHTB apparatus as installed in the Universidad Carlos III de Madrid Engineering Laboratory shown in figure 1 involves two bars called the incident and the transmission bars, and a specimen sandwiched between them made of the material being tested. The cylindrical bars are manufactured in a sole piece to facilitate the wave propagation study. Their dimensions are suitable for optimizing the experiments.

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Figure 1: Split Hopkinson Tension Bar apparatus as installed in the Universidad Carlos III de Madrid Engineering Laboratory.

The yield strength of the material used to fabricate the bars must be high enough to withstand the strains reached during the experiment. Its remaining properties must be precisely determined in order to foster the most reliable results.

Two strain gauges mounted on the incident and transmission bars enable the stress waves to be measured, as shown in fig. 2. The information gathered by the strain gauges is sent to a data acquisition system that consists of a signal conditioner and an oscilloscope, where test data can be computed.

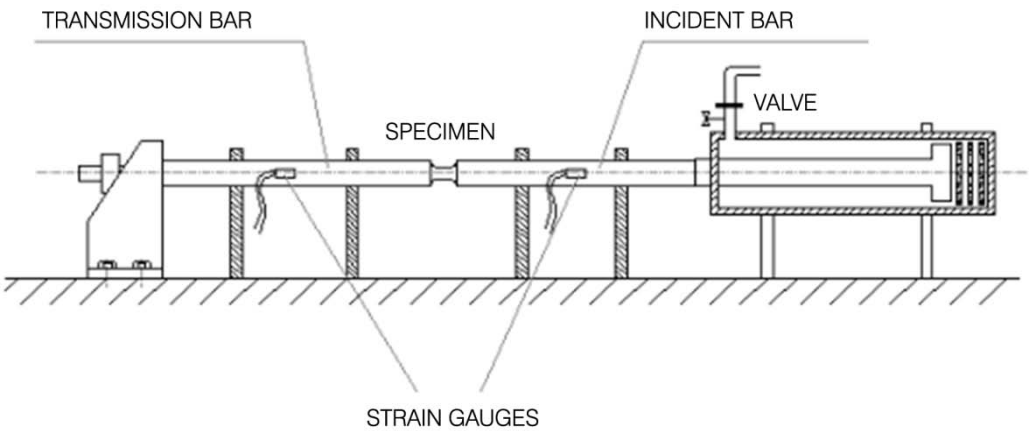

Figure 2 : Strain gauges mounted on the SHTB apparatus.

The specimen ends are screwed into both the incident and transmission bars. The incident bar, which is longer than the transmission bar, is impacted by the projectile.

The basic principle is to use a tubular projectile which impacts the flange of the incident bar to generate compression waves that will be converted to tensile waves by the flange. The projectile is a hollow cylinder that is launched using a chamber with compressed gas with a maximum pressure of 8 bar. The optimum pressure in every test for the required impact can be chosen using a control valve.

III. Results

The primary assumptions of the SHTB analysis are the uniform deformation of the specimen and the absence of stresses in transverse direction. Other assumptions include a constant strain rate while testing and quick equilibration of stresses in the specimen. According to the one-dimensional wave theory and the assumption of a uniaxial and homogeneous stress and strain in the specimen, the stress, strain and strain rate can be therefore calculated. The one-dimensional elastic wave theory is valid only if wave dispersion due to three-dimensional effects (radial inertia of the bars)

can be neglected. Therefore, the difference in the inner and outer elements considered must be negligible in the FE model as well.

All data shown below are relevant to the centre of the specimen (i.e. the area in which stresses and strains in the specimen reach their maximum values). Four elements are selected both in the incident and transmission bars at the strain gauge's height. They areplaced at a distance equal to 0, 4, 7.5, and 11 mm with respect to the centre of the bar.

The graphs depicted in figures 3 and 4 illustrate that there is no significant difference in the values obtained from the four elements considered.

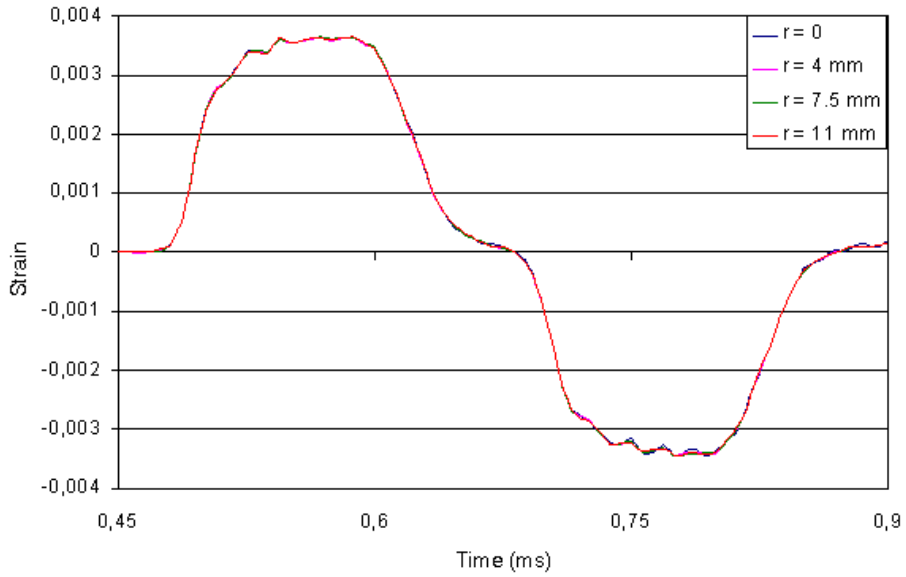

Figure 3 : Variation of strain with time as reached in four different elements of the incident bar placed at a distance equal to 0, 4, 7.5, and 11 mm.

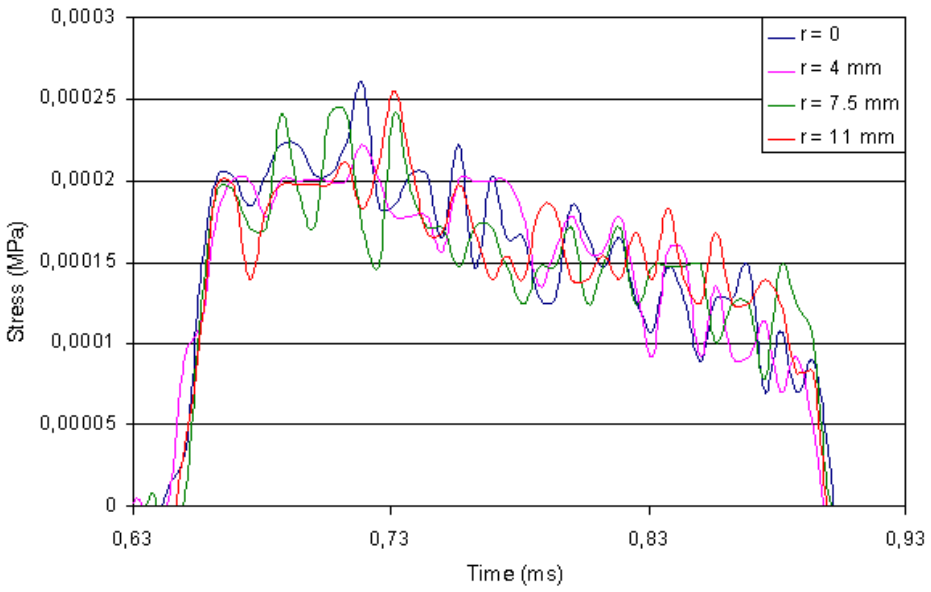

Figure 4 : Variation of strain with time as reached in four different elements of the transmission bar placed at a distance equal to 0, 4, 7.5, and 11 mm.

The one-dimensional wave theory is met for a strain rate equal to 1,300$s^{-1}$and a 33-cm long projectile. Other numerical simulations are accomplished to obtain the stress, the strain, and the strain rate corresponding to 20-cm long, 40-cm long, and 55-cm long projectiles.

Figure 5 shows the influence of the projectile's length on the behaviour of the incident and reflected waves.

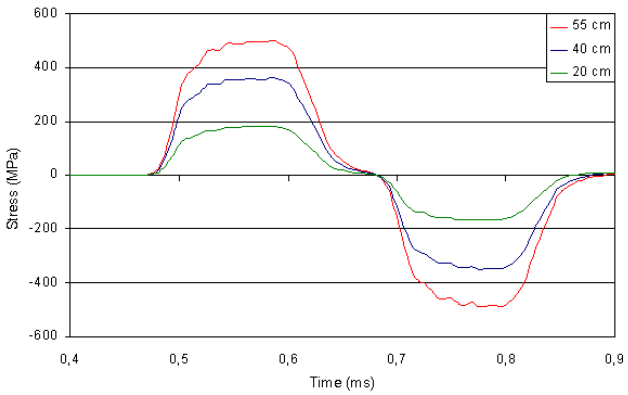

Figure 5 : Incident and reflected stress waves caused by the 20-cm long, 40-cm long, and 55-cm long projectiles.

The longest projectile produces a wave in which the stress values become the highest ones. On the contrary, the shortest projectile produces a wave in which the stress values happen to be the lowest ones. The incident wave caused by the 55-cm long projectile yields a maximum stress value equal to 480 MPa and the reflected wave relating to such projectile's length turns out a maximum stress value equal to 455 MPa. The incident wave caused by the 40-cm long projectile reaches a stress value of 350 MPa and the pertaining reflected wave yields 330 MPa. 175 MPa are reached by the incident wave and 155 MPa by the reflected wave when using the 20-cm long projectile. As shown in fig. 5, the incident wave is larger than the reflected one. This is due to the strike of the incident wave, which is partly reflected and partly transmitted to the specimen.

Every wave starts at 0.47 msand there is a slight difference in time duration when comparing the time values obtained by each projectile. The highest duration corresponds to the longest projectile. Such difference is minimal, since the waves' speed is really high(close to 5,170 m/s).

Another significant difference can be noticed when switching over from the incident wave to the reflected one. In this case the wave relevant to the shortest projectile tends to become horizontal, whereas those of the other ones remain inclined along the same portion of the curve. It can also be observed that the wave pertaining to the longest projectile happens to be the most inclined one. This occurrence shows that the longer the projectile is, the longer the time duration of the wave.

The transmitted waves are taken from the transmission bar of the model. The measurements are also taken from the points in which the strain gauges are placed in a real experiment. Figure 6 illustrates the influence of the rojectile's length on the behaviour of the transmitted waves.

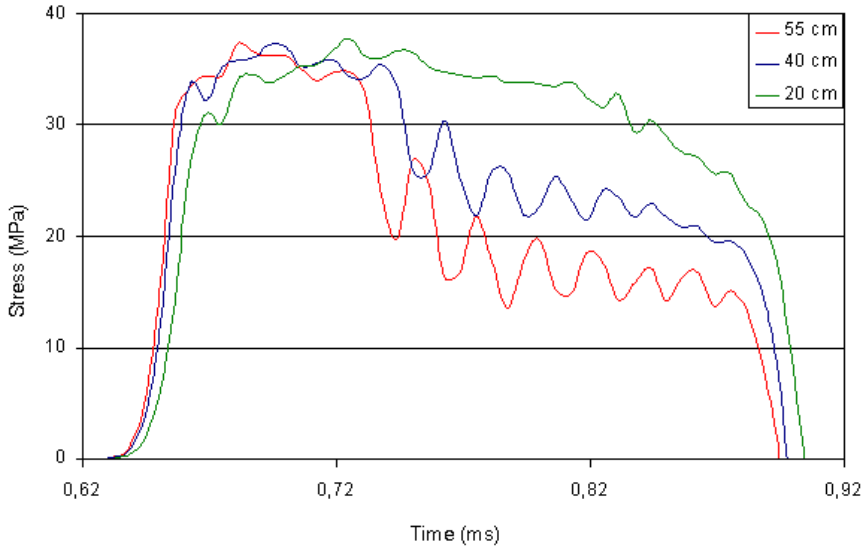

Figure 6 : Transmitted stress waves caused by the 20-cm long, 40-cm long, and 55-cm long projectiles.

Figure 6 shows that the maximum values of the waves transmitted by both the 55-cm long and the 40-cm long projectiles are alike. This occurrence is due to the high strains reached by the specimen, which are actually over its failure strain. Therefore, under such conditions the specimens would break after necking.

On the contrary, the specimen undergoes lower strain values when it isimpacted by the 20-cm projectile. The specimen does not reach its ultimate tensile strength and therefore no necking effects are observed in the specimen. Figure 7 shows the strain values caused in the midpoint of the specimen's gauge length resulting from the impacts of projectiles with different sizes. It can be observed that the highest strains turn out to occur when using the longest projectiles. The slope of the linear portions of each curveindicates the value of the strain rate. Since the steepest slope is that of the 55-cm long projectile, it can be inferred that the longest projectile causes a higher strain rate than the others.

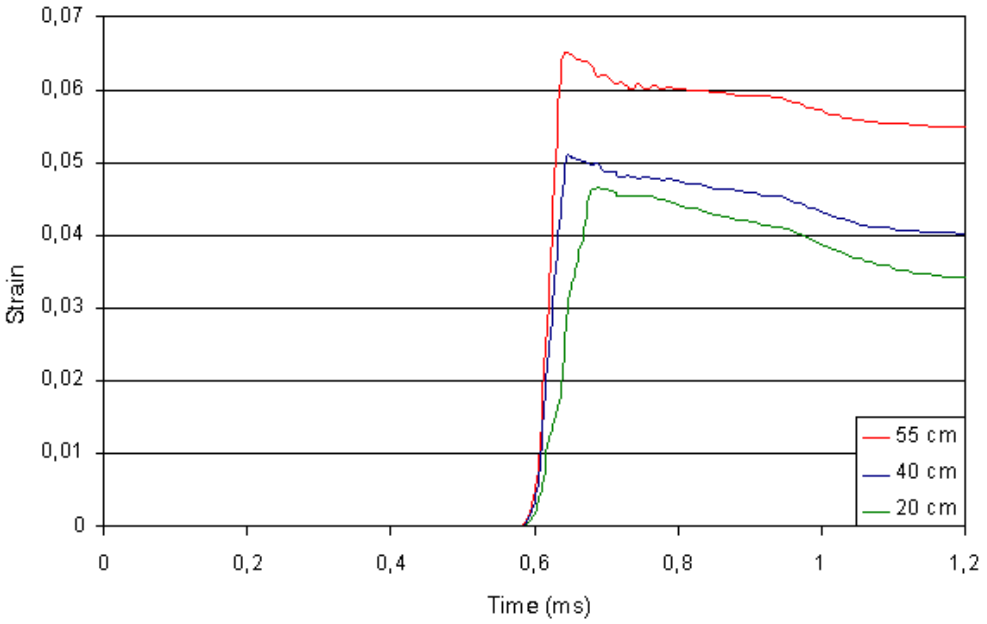

Figure 7: Variations of strain with time in the specimen caused by the 20-cm long, 40-cm long, and 55-cm long projectiles.

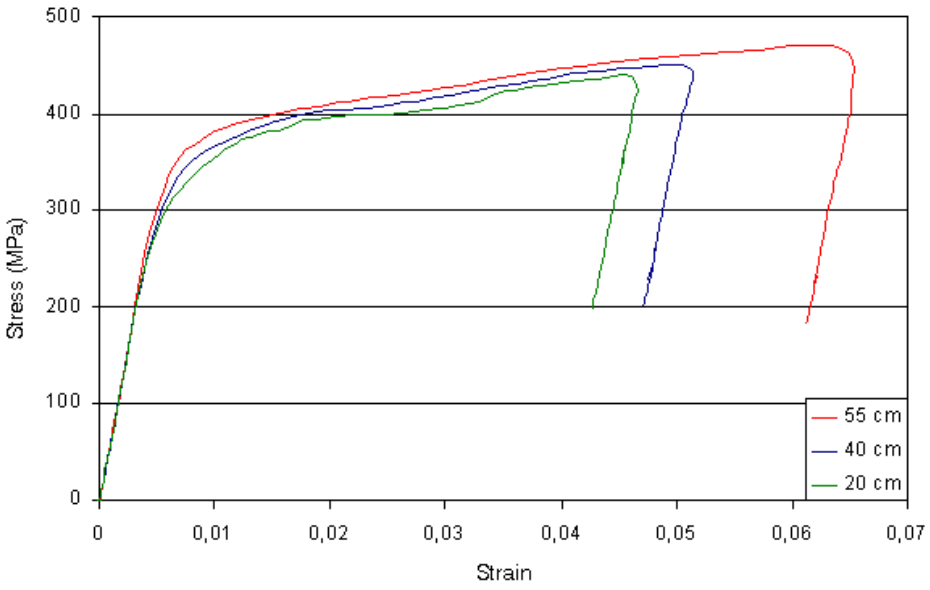

Figure 8 : Stress-strain curves in the specimencaused by the 20-cm long, 40-cm long, and 55-cm long projectiles.

The strain rate of the specimen is computed as the derivative of the variation of strain with time at the midpoint of the sample. Figure 9 shows the values of strain rates obtained when using different lengths of the same projectile.

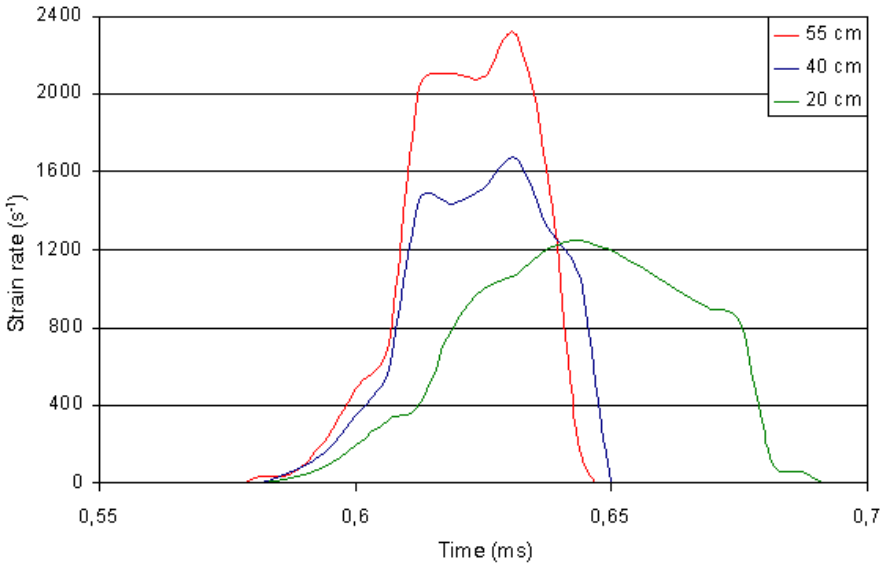

Figure 9 : Strain rates obtained when using the 20-cm long, 40-cm long, and 55-cm long projectiles.

It can be observed that the 55-cm long projectile impacts at a strain rate equal to $2100s^{-1}$ approximately, whereas the 40-cm long projectile reaches a maximum value of the strain rate which is in the region of $1500s^{-1}$.The 20-cm long projectile impacts around $1000s^{-1}$.

IV. Conclusions

A numerical analysis of the SHTB experiments was accomplished by using the FE method. Results of numerical simulations of SHTB experiments were presented considering different projectile's lengths. Different strain rates wereobtained when varying the projectile's length always provided that its speed remained constant. The simulation results show that the projectile's length has a significant effect on thestrain obtained in the specimen. The 20-cm long projectile yields the highest time duration. It was observed that necking takes place in the portion of the gauge length which is closer to the incident bar. The maximum stress

values concentrate in such portion and therefore it undergoes the maximum strain values. The higher the strain rate is, the lower its time duration. The strains and strain rates obtained are higher when using the 50-cm long projectile.It can be deduced that if specimens with higher ultimate tensile strength are to be tested, the impact pressure in the incident bar must increase or otherwise longer projectiles must be used.

V. Acknowledgements

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As FARSE, you will be given a renowned, secure and free professional email address with 100 GB of space e.g. johnhall@globaljournals.org. This will include Webmail, Spam Assassin, Email Forwarders,Auto-Responders, Email Delivery Route tracing, etc.

The FARSE will be eligible for a free application of standardization of their researches. Standardization of research will be subject to acceptability within stipulated norms as the next step after publishing in a journal. We shall depute a team of specialized research professionals who will render their services for elevating your researches to next higher level, which is worldwide open standardization.

The FARSE member can apply for grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A. Once you are designated as FARSE, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria. After certification of all your credentials by OARS, they will be published on your Fellow Profile link on website https://associationofresearch.org which will be helpful to upgrade the dignity.

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The 'MARSE ' title is accorded to a selected professional after the approval of the Editor-in-Chief / Editorial Board Members/Dean.

The "MARSE" is a dignified ornament which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., MARSE or William Walldroff, M.S., MARSE.

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We shall provide you intimation regarding launching of e-version of journal of your stream time to time.This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

The MARSE member can apply for approval, grading and certification of standards of their educational and Institutional Degrees to Open Association of Research, Society U.S.A.

Once you are designated as MARSE, you may send us a scanned copy of all of your credentials. OARS will verify, grade and certify them. This will be based on your academic records, quality of research papers published by you, and some more criteria.

It is mandatory to read all terms and conditions carefully.

AUXILIARY MEMBERSHIPS

Institutional Fellow of Open Association of Research Society (USA)-OARS (USA)

Global Journals Incorporation (USA) is accredited by Open Association of Research Society, U.S.A (OARS) and in turn, affiliates research institutions as "Institutional Fellow of Open Association of Research Society" (IFOARS).

The "FARSC" is a dignified title which is accorded to a person's name viz. Dr. John E. Hall, Ph.D., FARSC or William Walldroff, M.S., FARSC.

The IFOARS institution is entitled to form a Board comprised of one Chairperson and three to five board members preferably from different streams. The Board will be recognized as "Institutional Board of Open Association of Research Society"-(IBOARS).

The Institute will be entitled to following benefits:

The IBOARS can initially review research papers of their institute and recommend them to publish with respective journal of Global Journals. It can also review the papers of other institutions after obtaining our consent. The second review will be done by peer reviewer of Global Journals Incorporation (USA) The Board is at liberty to appoint a peer reviewer with the approval of chairperson after consulting us.

The author fees of such paper may be waived off up to 40%.

The Global Journals Incorporation (USA) at its discretion can also refer double blind peer reviewed paper at their end to the board for the verification and to get recommendation for final stage of acceptance of publication.

The IBOARS can organize symposium/seminar/conference in their country on behalf of Global Journals Incorporation (USA)-OARS (USA). The terms and conditions can be discussed separately.

The Board can also play vital role by exploring and giving valuable suggestions regarding the Standards of "Open Association of Research Society, U.S.A (OARS)" so that proper amendment can take place for the benefit of entire research community. We shall provide details of particular standard only on receipt of request from the Board.

The board members can also join us as Individual Fellow with 40% discount on total fees applicable to Individual Fellow. They will be entitled to avail all the benefits as declared. Please visit Individual Fellow-sub menu of GlobalJournals.org to have more relevant details.

We shall provide you intimation regarding launching of e-version of journal of your stream time to time. This may be utilized in your library for the enrichment of knowledge of your students as well as it can also be helpful for the concerned faculty members.

After nomination of your institution as "Institutional Fellow" and constantly functioning successfully for one year, we can consider giving recognition to your institute to function as Regional/Zonal office on our behalf.
The board can also take up the additional allied activities for betterment after our consultation.

The following entitlements are applicable to individual Fellows:

Open Association of Research Society, U.S.A (OARS) By-laws states that an individual Fellow may use the designations as applicable, or the corresponding initials. The Credentials of individual Fellow and Associate designations signify that the individual has gained knowledge of the fundamental concepts. One is magnanimous and proficient in an expertise course covering the professional code of conduct, and follows recognized standards of practice.

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Other:

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- The professional accredited with Fellow honor, is entitled to various benefits viz. name, fame, honor, regular flow of income, secured bright future, social status etc.

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- The Fellow can organize symposium/seminar/conference on behalf of Global Journals Incorporation (USA) and he/she can also attend the same organized by other institutes on behalf of Global Journals.
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- The Fellow can earn 60% of sales proceeds from the sale of reference/review books/literature/publishing of research paper.
- Fellow can also join as paid peer reviewer and earn 15% remuneration of author charges and can also get an opportunity to join as member of the Editorial Board of Global Journals Incorporation (USA)
- • This individual has learned the basic methods of applying those concepts and techniques to common challenging situations. This individual has further demonstrated an in–depth understanding of the application of suitable techniques to a particular area of research practice.

Note :

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- In future, if the board feels the necessity to change any board member, the same can be done with the consent of the chairperson along with anyone board member without our approval.
- In case, the chairperson needs to be replaced then consent of 2/3rd board members are required and they are also required to jointly pass the resolution copy of which should be sent to us. In such case, it will be compulsory to obtain our approval before replacement.
- In case of "Difference of Opinion [if any]" among the Board members, our decision will be final and binding to everyone.

"

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The Area or field of specialization may or may not be of any category as mentioned in 'Scope of Journal' menu of the GlobalJournals.org website. There are 37 Research Journal categorized with Six parental Journals GJCST, GJMR, GJRE, GJMBR, GJSFR, GJHSS. For Authors should prefer the mentioned categories. There are three widely used systems UDC, DDC and LCC. The details are available as 'Knowledge Abstract' at Home page. The major advantage of this coding is that, the research work will be exposed to and shared with all over the world as we are being abstracted and indexed worldwide.

The paper should be in proper format. The format can be downloaded from first page of 'Author Guideline' Menu. The Author is expected to follow the general rules as mentioned in this menu. The paper should be written in MS-Word Format (*.DOC,*.DOCX).

The Author can submit the paper either online or offline. The authors should prefer online submission.Online Submission: There are three ways to submit your paper:

(A) (I) First, register yourself using top right corner of Home page then Login. If you are already registered, then login using your username and password.

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You can use your own standard format also.
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1. General,

2. Ethical Guidelines,

3. Submission of Manuscripts,

4. Manuscript's Category,

5. Structure and Format of Manuscript,

6. After Acceptance.

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The Global Journals Inc. (US) welcome the submission of original paper, review paper, survey article relevant to the all the streams of Philosophy and knowledge. The Global Journals Inc. (US) is parental platform for Global Journal of Computer Science and Technology, Researches in Engineering, Medical Research, Science Frontier Research, Human Social Science, Management, and Business organization. The choice of specific field can be done otherwise as following in Abstracting and Indexing Page on this Website. As the all Global

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2) Drafting the paper and revising it critically regarding important academic content.

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All authors should have been credited according to their appropriate contribution in research activity and preparing paper. Contributors who do not match the criteria as authors may be mentioned under Acknowledgement.

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To avoid postal delays, all transaction is preferred by e-mail. A finished manuscript submission is confirmed by e-mail immediately and your paper enters the editorial process with no postal delays. When a conclusion is made about the publication of your paper by our Editorial Board, revisions can be submitted online with the same procedure, with an occasion to view and respond to all comments.

Complete support for both authors and co-author is provided.

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Based on potential and nature, the manuscript can be categorized under the following heads:

Original research paper: Such papers are reports of high-level significant original research work.

Review papers: These are concise, significant but helpful and decisive topics for young researchers.

Research articles: These are handled with small investigation and applications

Research letters: The letters are small and concise comments on previously published matters.

5.STRUCTURE AND FORMAT OF MANUSCRIPT

The recommended size of original research paper is less than seven thousand words, review papers fewer than seven thousands words also.Preparation of research paper or how to write research paper, are major hurdle, while writing manuscript. The research articles and research letters should be fewer than three thousand words, the structure original research paper; sometime review paper should be as follows:

Papers: These are reports of significant research (typically less than 7000 words equivalent, including tables, figures, references), and comprise:

(a)Title should be relevant and commensurate with the theme of the paper.

(b) A brief Summary, "Abstract" (less than 150 words) containing the major results and conclusions.

(c) Up to ten keywords, that precisely identifies the paper's subject, purpose, and focus.

(d) An Introduction, giving necessary background excluding subheadings; objectives must be clearly declared.

(e) Resources and techniques with sufficient complete experimental details (wherever possible by reference) to permit repetition; sources of information must be given and numerical methods must be specified by reference, unless non-standard.

(f) Results should be presented concisely, by well-designed tables and/or figures; the same data may not be used in both; suitable statistical data should be given. All data must be obtained with attention to numerical detail in the planning stage. As reproduced design has been recognized to be important to experiments for a considerable time, the Editor has decided that any paper that appears not to have adequate numerical treatments of the data will be returned un-refereed;

(g) Discussion should cover the implications and consequences, not just recapitulating the results; conclusions should be summarizing.

(h) Brief Acknowledgements.

(i) References in the proper form.

Authors should very cautiously consider the preparation of papers to ensure that they communicate efficiently. Papers are much more likely to be accepted, if they are cautiously designed and laid out, contain few or no errors, are summarizing, and be conventional to the approach and instructions. They will in addition, be published with much less delays than those that require much technical and editorial correction.

The Editorial Board reserves the right to make literary corrections and to make suggestions to improve briefness.

It is vital, that authors take care in submitting a manuscript that is written in simple language and adheres to published guidelines.

Format

Language: The language of publication is UK English. Authors, for whom English is a second language, must have their manuscript efficiently edited by an English-speaking person before submission to make sure that, the English is of high excellence. It is preferable, that manuscripts should be professionally edited.

Standard Usage, Abbreviations, and Units: Spelling and hyphenation should be conventional to The Concise Oxford English Dictionary. Statistics and measurements should at all times be given in figures, e.g. 16 min, except for when the number begins a sentence. When the number does not refer to a unit of measurement it should be spelt in full unless, it is 160 or greater.

Abbreviations supposed to be used carefully. The abbreviated name or expression is supposed to be cited in full at first usage, followed by the conventional abbreviation in parentheses.

Metric SI units are supposed to generally be used excluding where they conflict with current practice or are confusing. For illustration, 1.4 l rather than 1.4 × 10-3 m3, or 4 mm somewhat than 4 × 10-3 m. Chemical formula and solutions must identify the form used, e.g. anhydrous or hydrated, and the concentration must be in clearly defined units. Common species names should be followed by underlines at the first mention. For following use the generic name should be constricted to a single letter, if it is clear.

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Optimizing Abstract for Search Engines

Many researchers searching for information online will use search engines such as Google, Yahoo or similar. By optimizing your paper for search engines, you will amplify the chance of someone finding it. This in turn will make it more likely to be viewed and/or cited in a further work. Global Journals Inc. (US) have compiled these guidelines to facilitate you to maximize the web-friendliness of the most public part of your paper.

Key Words

A major linchpin in research work for the writing research paper is the keyword search, which one will employ to find both library and Internet resources.

One must be persistent and creative in using keywords. An effective keyword search requires a strategy and planning a list of possible keywords and phrases to try.

Search engines for most searches, use Boolean searching, which is somewhat different from Internet searches. The Boolean search uses "operators," words (and, or, not, and near) that enable you to expand or narrow your affords. Tips for research paper while preparing research paper are very helpful guideline of research paper.

Choice of key words is first tool of tips to write research paper. Research paper writing is an art.A few tips for deciding as strategically as possible about keyword search:

- One should start brainstorming lists of possible keywords before even begin searching. Think about the most important concepts related to research work. Ask, "What words would a source have to include to be truly valuable in research paper?" Then consider synonyms for the important words.
- It may take the discovery of only one relevant paper to let steer in the right keyword direction because in most databases, the keywords under which a research paper is abstracted are listed with the paper.
- One should avoid outdated words.

Keywords are the key that opens a door to research work sources. Keyword searching is an art in which researcher's skills are bound to improve with experience and time.

Numerical Methods: Numerical methods used should be clear and, where appropriate, supported by references.

Acknowledgements: Please make these as concise as possible.

References

References follow the Harvard scheme of referencing. References in the text should cite the authors' names followed by the time of their publication, unless there are three or more authors when simply the first author's name is quoted followed by et al. unpublished work has to only be cited where necessary, and only in the text. Copies of references in press in other journals have to be supplied with submitted typescripts. It is necessary that all citations and references be carefully checked before submission, as mistakes or omissions will cause delays.

References to information on the World Wide Web can be given, but only if the information is available without charge to readers on an official site. Wikipedia and Similar websites are not allowed where anyone can change the information. Authors will be asked to make available electronic copies of the cited information for inclusion on the Global Journals Inc. (US) homepage at the judgment of the Editorial Board.

The Editorial Board and Global Journals Inc. (US) recommend that, citation of online-published papers and other material should be done via a DOI (digital object identifier). If an author cites anything, which does not have a DOI, they run the risk of the cited material not being noticeable.

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Figures: Figures are supposed to be submitted as separate files. Always take in a citation in the text for each figure using Arabic numbers, e.g. Fig. 4. Artwork must be submitted online in electronic form by e-mailing them.

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Even though low quality images are sufficient for review purposes, print publication requires high quality images to prevent the final product being blurred or fuzzy. Submit (or e-mail) EPS (line art) or TIFF (halftone/photographs) files only. MS PowerPoint and Word Graphics are unsuitable for printed pictures. Do not use pixel-oriented software. Scans (TIFF only) should have a resolution of at least 350 dpi (halftone) or 700 to 1100 dpi (line drawings) in relation to the imitation size. Please give the data for figures in black and white or submit a Color Work Agreement Form. EPS files must be saved with fonts embedded (and with a TIFF preview, if possible).

For scanned images, the scanning resolution (at final image size) ought to be as follows to ensure good reproduction: line art: >650 dpi; halftones (including gel photographs) : >350 dpi; figures containing both halftone and line images: >650 dpi.

Figure Legends: Self-explanatory legends of all figures should be incorporated separately under the heading 'Legends to Figures'. In the full-text online edition of the journal, figure legends may possibly be truncated in abbreviated links to the full screen version. Therefore, the first 100 characters of any legend should notify the reader, about the key aspects of the figure.

6. AFTER ACCEPTANCE

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Before start writing a good quality Computer Science Research Paper, let us first understand what is Computer Science Research Paper? So, Computer Science Research Paper is the paper which is written by professionals or scientists who are associated to Computer Science and Information Technology, or doing research study in these areas. If you are novel to this field then you can consult about this field from your supervisor or guide.

TECHNIQUES FOR WRITING A GOOD QUALITY RESEARCH PAPER:

1. Choosing the topic: In most cases, the topic is searched by the interest of author but it can be also suggested by the guides. You can have several topics and then you can judge that in which topic or subject you are finding yourself most comfortable. This can be done by asking several questions to yourself, like Will I be able to carry our search in this area? Will I find all necessary recourses to accomplish the search? Will I be able to find all information in this field area? If the answer of these types of questions will be "Yes" then you can choose that topic. In most of the cases, you may have to conduct the surveys and have to visit several places because this field is related to Computer Science and Information Technology. Also, you may have to do a lot of work to find all rise and falls regarding the various data of that subject. Sometimes, detailed information plays a vital role, instead of short information.

2. Evaluators are human: First thing to remember that evaluators are also human being. They are not only meant for rejecting a paper. They are here to evaluate your paper. So, present your Best.

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4. Make blueprints of paper: The outline is the plan or framework that will help you to arrange your thoughts. It will make your paper logical. But remember that all points of your outline must be related to the topic you have chosen.

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7. Use right software: Always use good quality software packages. If you are not capable to judge good software then you can lose quality of your paper unknowingly. There are various software programs available to help you, which you can get through Internet.

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9. Use and get big pictures: Always use encyclopedias, Wikipedia to get pictures so that you can go into the depth.

10. Bookmarks are useful: When you read any book or magazine, you generally use bookmarks, right! It is a good habit, which helps to not to lose your continuity. You should always use bookmarks while searching on Internet also, which will make your search easier.

11. Revise what you wrote: When you write anything, always read it, summarize it and then finalize it.

12. Make all efforts: Make all efforts to mention what you are going to write in your paper. That means always have a good start. Try to mention everything in introduction, that what is the need of a particular research paper. Polish your work by good skill of writing and always give an evaluator, what he wants.

13. Have backups: When you are going to do any important thing like making research paper, you should always have backup copies of it either in your computer or in paper. This will help you to not to lose any of your important.

14. Produce good diagrams of your own: Always try to include good charts or diagrams in your paper to improve quality. Using several and unnecessary diagrams will degrade the quality of your paper by creating "hotchpotch." So always, try to make and include those diagrams, which are made by your own to improve readability and understandability of your paper.

15. Use of direct quotes: When you do research relevant to literature, history or current affairs then use of quotes become essential but if study is relevant to science then use of quotes is not preferable.

16. Use proper verb tense: Use proper verb tenses in your paper. Use past tense, to present those events that happened. Use present tense to indicate events that are going on. Use future tense to indicate future happening events. Use of improper and wrong tenses will confuse the evaluator. Avoid the sentences that are incomplete.

17. Never use online paper: If you are getting any paper on Internet, then never use it as your research paper because it might be possible that evaluator has already seen it or maybe it is outdated version.

18. Pick a good study spot: To do your research studies always try to pick a spot, which is quiet. Every spot is not for studies. Spot that suits you choose it and proceed further.

19. Know what you know: Always try to know, what you know by making objectives. Else, you will be confused and cannot achieve your target.

20. Use good quality grammar: Always use a good quality grammar and use words that will throw positive impact on evaluator. Use of good quality grammar does not mean to use tough words, that for each word the evaluator has to go through dictionary. Do not start sentence with a conjunction. Do not fragment sentences. Eliminate one-word sentences. Ignore passive voice. Do not ever use a big word when a diminutive one would suffice. Verbs have to be in agreement with their subjects. Prepositions are not expressions to finish sentences with. It is incorrect to ever divide an infinitive. Avoid clichés like the disease. Also, always shun irritating alliteration. Use language that is simple and straight forward. put together a neat summary.

21. Arrangement of information: Each section of the main body should start with an opening sentence and there should be a changeover at the end of the section. Give only valid and powerful arguments to your topic. You may also maintain your arguments with records.

22. Never start in last minute: Always start at right time and give enough time to research work. Leaving everything to the last minute will degrade your paper and spoil your work.

23. Multitasking in research is not good: Doing several things at the same time proves bad habit in case of research activity. Research is an area, where everything has a particular time slot. Divide your research work in parts and do particular part in particular time slot.

24. Never copy others' work: Never copy others' work and give it your name because if evaluator has seen it anywhere you will be in trouble.

25. Take proper rest and food: No matter how many hours you spend for your research activity, if you are not taking care of your health then all your efforts will be in vain. For a quality research, study is must, and this can be done by taking proper rest and food.

26. Go for seminars: Attend seminars if the topic is relevant to your research area. Utilize all your resources.

27. Refresh your mind after intervals: Try to give rest to your mind by listening to soft music or by sleeping in intervals. This will also improve your memory.

28. Make colleagues: Always try to make colleagues. No matter how sharper or intelligent you are, if you make colleagues you can have several ideas, which will be helpful for your research.

29. Think technically: Always think technically. If anything happens, then search its reasons, its benefits, and demerits.

30. Think and then print: When you will go to print your paper, notice that tables are not be split, headings are not detached from their descriptions, and page sequence is maintained.

31. Adding unnecessary information: Do not add unnecessary information, like, I have used MS Excel to draw graph. Do not add irrelevant and inappropriate material. These all will create superfluous. Foreign terminology and phrases are not apropos. One should NEVER take a broad view. Analogy in script is like feathers on a snake. Not at all use a large word when a very small one would be sufficient. Use words properly, regardless of how others use them. Remove quotations. Puns are for kids, not grunt readers. Amplification is a billion times of inferior quality than sarcasm.

32. Never oversimplify everything: To add material in your research paper, never go for oversimplification. This will definitely irritate the evaluator. Be more or less specific. Also too, by no means, ever use rhythmic redundancies. Contractions aren't essential and shouldn't be there used. Comparisons are as terrible as clichés. Give up ampersands and abbreviations, and so on. Remove commas, that are, not necessary. Parenthetical words however should be together with this in commas. Understatement is all the time the complete best way to put onward earth-shaking thoughts. Give a detailed literary review.

33. Report concluded results: Use concluded results. From raw data, filter the results and then conclude your studies based on measurements and observations taken. Significant figures and appropriate number of decimal places should be used. Parenthetical remarks are prohibitive. Proofread carefully at final stage. In the end give outline to your arguments. Spot out perspectives of further study of this subject. Justify your conclusion by at the bottom of them with sufficient justifications and examples.

34. After conclusion: Once you have concluded your research, the next most important step is to present your findings. Presentation is extremely important as it is the definite medium though which your research is going to be in print to the rest of the crowd. Care should be taken to categorize your thoughts well and present them in a logical and neat manner. A good quality research paper format is essential because it serves to highlight your research paper and bring to light all necessary aspects in your research.

Informal Guidelines of Research Paper Writing

Key points to remember:

- Submit all work in its final form.
- Write your paper in the form, which is presented in the guidelines using the template.
- Please note the criterion for grading the final paper by peer-reviewers.

Final Points:

A purpose of organizing a research paper is to let people to interpret your effort selectively. The journal requires the following sections, submitted in the order listed, each section to start on a new page.

The introduction will be compiled from reference matter and will reflect the design processes or outline of basis that direct you to make study. As you will carry out the process of study, the method and process section will be constructed as like that. The result segment will show related statistics in nearly sequential order and will direct the reviewers next to the similar intellectual paths throughout the data that you took to carry out your study. The discussion section will provide understanding of the data and projections as to the implication of the results. The use of good quality references all through the paper will give the effort trustworthiness by representing an alertness of prior workings.

Writing a research paper is not an easy job no matter how trouble-free the actual research or concept. Practice, excellent preparation, and controlled record keeping are the only means to make straightforward the progression.

General style:

Specific editorial column necessities for compliance of a manuscript will always take over from directions in these general guidelines.

To make a paper clear

· Adhere to recommended page limits

Mistakes to evade

- Insertion a title at the foot of a page with the subsequent text on the next page
- Separating a table/chart or figure - impound each figure/table to a single page
- Submitting a manuscript with pages out of sequence

In every sections of your document

· Use standard writing style including articles ("a", "the," etc.)

· Keep on paying attention on the research topic of the paper

· Use paragraphs to split each significant point (excluding for the abstract)

· Align the primary line of each section

· Present your points in sound order

· Use present tense to report well accepted

· Use past tense to describe specific results

· Shun familiar wording, don't address the reviewer directly, and don't use slang, slang language, or superlatives

· Shun use of extra pictures - include only those figures essential to presenting results

Title Page:

Choose a revealing title. It should be short. It should not have non-standard acronyms or abbreviations. It should not exceed two printed lines. It should include the name(s) and address (es) of all authors.

Abstract:

The summary should be two hundred words or less. It should briefly and clearly explain the key findings reported in the manuscript--must have precise statistics. It should not have abnormal acronyms or abbreviations. It should be logical in itself. Shun citing references at this point.

An abstract is a brief distinct paragraph summary of finished work or work in development. In a minute or less a reviewer can be taught the foundation behind the study, common approach to the problem, relevant results, and significant conclusions or new questions.

Write your summary when your paper is completed because how can you write the summary of anything which is not yet written? Wealth of terminology is very essential in abstract. Yet, use comprehensive sentences and do not let go readability for briefness. You can maintain it succinct by phrasing sentences so that they provide more than lone rationale. The author can at this moment go straight to shortening the outcome. Sum up the study, with the subsequent elements in any summary. Try to maintain the initial two items to no more than one ruling each.

- Reason of the study - theory, overall issue, purpose
- Fundamental goal
- To the point depiction of the research
- Consequences, including definite statistics - if the consequences are quantitative in nature, account quantitative data; results of any numerical analysis should be reported
- Significant conclusions or questions that track from the research(es)

Approach:

- Single section, and succinct
- As a outline of job done, it is always written in past tense
- A conceptual should situate on its own, and not submit to any other part of the paper such as a form or table
- Center on shortening results - bound background information to a verdict or two, if completely necessary
- What you account in an conceptual must be regular with what you reported in the manuscript
- Exact spelling, clearness of sentences and phrases, and appropriate reporting of quantities (proper units, important statistics) are just as significant in an abstract as they are anywhere else

Introduction:

The **Introduction** should "introduce" the manuscript. The reviewer should be presented with sufficient background information to be capable to comprehend and calculate the purpose of your study without having to submit to other works. The basis for the study should be offered. Give most important references but shun difficult to make a comprehensive appraisal of the topic. In the introduction, describe the problem visibly. If the problem is not acknowledged in a logical, reasonable way, the reviewer will have no attention in your result. Speak in common terms about techniques used to explain the problem, if needed, but do not present any particulars about the protocols here. Following approach can create a valuable beginning:

- Explain the value (significance) of the study
- Shield the model - why did you employ this particular system or method? What is its compensation? You strength remark on its appropriateness from a abstract point of vision as well as point out sensible reasons for using it.
- Present a justification. Status your particular theory (es) or aim(s), and describe the logic that led you to choose them.
- Very for a short time explain the tentative propose and how it skilled the declared objectives.

Approach:

- Use past tense except for when referring to recognized facts. After all, the manuscript will be submitted after the entire job is done.
- Sort out your thoughts; manufacture one key point with every section. If you make the four points listed above, you will need a least of four paragraphs.

- Present surroundings information only as desirable in order hold up a situation. The reviewer does not desire to read the whole thing you know about a topic.
- Shape the theory/purpose specifically - do not take a broad view.
- As always, give awareness to spelling, simplicity and correctness of sentences and phrases.

Procedures (Methods and Materials):

This part is supposed to be the easiest to carve if you have good skills. A sound written Procedures segment allows a capable scientist to replacement your results. Present precise information about your supplies. The suppliers and clarity of reagents can be helpful bits of information. Present methods in sequential order but linked methodologies can be grouped as a segment. Be concise when relating the protocols. Attempt for the least amount of information that would permit another capable scientist to spare your outcome but be cautious that vital information is integrated. The use of subheadings is suggested and ought to be synchronized with the results section. When a technique is used that has been well described in another object, mention the specific item describing a way but draw the basic principle while stating the situation. The purpose is to text all particular resources and broad procedures, so that another person may use some or all of the methods in one more study or referee the scientific value of your work. It is not to be a step by step report of the whole thing you did, nor is a methods section a set of orders.

Materials:

- Explain materials individually only if the study is so complex that it saves liberty this way.
- Embrace particular materials, and any tools or provisions that are not frequently found in laboratories.
- Do not take in frequently found.
- If use of a definite type of tools.
- Materials may be reported in a part section or else they may be recognized along with your measures.

Methods:

- Report the method (not particulars of each process that engaged the same methodology)
- Describe the method entirely
- To be succinct, present methods under headings dedicated to specific dealings or groups of measures
- Simplify - details how procedures were completed not how they were exclusively performed on a particular day.
- If well known procedures were used, account the procedure by name, possibly with reference, and that's all.

Approach:

- It is embarrassed or not possible to use vigorous voice when documenting methods with no using first person, which would focus the reviewer's interest on the researcher rather than the job. As a result when script up the methods most authors use third person passive voice.
- Use standard style in this and in every other part of the paper - avoid familiar lists, and use full sentences.

What to keep away from

- Resources and methods are not a set of information.
- Skip all descriptive information and surroundings - save it for the argument.
- Leave out information that is immaterial to a third party.

Results:

The principle of a results segment is to present and demonstrate your conclusion. Create this part a entirely objective details of the outcome, and save all understanding for the discussion.

The page length of this segment is set by the sum and types of data to be reported. Carry on to be to the point, by means of statistics and tables, if suitable, to present consequences most efficiently.You must obviously differentiate material that would usually be incorporated in a study editorial from any unprocessed data or additional appendix matter that would not be available. In fact, such matter should not be submitted at all except requested by the instructor.

Content

- Sum up your conclusion in text and demonstrate them, if suitable, with figures and tables.
- In manuscript, explain each of your consequences, point the reader to remarks that are most appropriate.
- Present a background, such as by describing the question that was addressed by creation an exacting study.
- Explain results of control experiments and comprise remarks that are not accessible in a prescribed figure or table, if appropriate.
- Examine your data, then prepare the analyzed (transformed) data in the form of a figure (graph), table, or in manuscript form.

What to stay away from

- Do not discuss or infer your outcome, report surroundings information, or try to explain anything.
- Not at all, take in raw data or intermediate calculations in a research manuscript.
- Do not present the similar data more than once.
- Manuscript should complement any figures or tables, not duplicate the identical information.
- Never confuse figures with tables - there is a difference.

Approach

- As forever, use past tense when you submit to your results, and put the whole thing in a reasonable order.
- Put figures and tables, appropriately numbered, in order at the end of the report
- If you desire, you may place your figures and tables properly within the text of your results part.

Figures and tables

- If you put figures and tables at the end of the details, make certain that they are visibly distinguished from any attach appendix materials, such as raw facts
- Despite of position, each figure must be numbered one after the other and complete with subtitle
- In spite of position, each table must be titled, numbered one after the other and complete with heading
- All figure and table must be adequately complete that it could situate on its own, divide from text

Discussion:

The Discussion is expected the trickiest segment to write and describe. A lot of papers submitted for journal are discarded based on problems with the Discussion. There is no head of state for how long a argument should be. Position your understanding of the outcome visibly to lead the reviewer through your conclusions, and then finish the paper with a summing up of the implication of the study. The purpose here is to offer an understanding of your results and hold up for all of your conclusions, using facts from your research and generally accepted information, if suitable. The implication of result should be visibly described. Infer your data in the conversation in suitable depth. This means that when you clarify an observable fact you must explain mechanisms that may account for the observation. If your results vary from your prospect, make clear why that may have happened. If your results agree, then explain the theory that the proof supported. It is never suitable to just state that the data approved with prospect, and let it drop at that.

- Make a decision if each premise is supported, discarded, or if you cannot make a conclusion with assurance. Do not just dismiss a study or part of a study as "uncertain."
- Research papers are not acknowledged if the work is imperfect. Draw what conclusions you can based upon the results that you have, and take care of the study as a finished work
- You may propose future guidelines, such as how the experiment might be personalized to accomplish a new idea.
- Give details all of your remarks as much as possible, focus on mechanisms.
- Make a decision if the tentative design sufficiently addressed the theory, and whether or not it was correctly restricted.
- Try to present substitute explanations if sensible alternatives be present.
- One research will not counter an overall question, so maintain the large picture in mind, where do you go next? The best studies unlock new avenues of study. What questions remain?
- Recommendations for detailed papers will offer supplementary suggestions.

Approach:

- When you refer to information, differentiate data generated by your own studies from available information
- Submit to work done by specific persons (including you) in past tense.
- Submit to generally acknowledged facts and main beliefs in present tense.

Please carefully note down following rules and regulation before submitting your Research Paper to Global Journals Inc. (US):

Segment Draft and Final Research Paper: You have to strictly follow the template of research paper. If it is not done your paper may get rejected.

- The **major constraint** is that you must independently make all content, tables, graphs, and facts that are offered in the paper. You must write each part of the paper wholly on your own. The Peer-reviewers need to identify your own perceptive of the concepts in your own terms. NEVER extract straight from any foundation, and never rephrase someone else's analysis.

- Do not give permission to anyone else to "PROOFREAD" your manuscript.

- Methods to avoid Plagiarism is applied by us on every paper, if found guilty, you will be blacklisted by all of our collaborated research groups, your institution will be informed for this and strict legal actions will be taken immediately.)
- To guard yourself and others from possible illegal use please do not permit anyone right to use to your paper and files.

Criterion for Grading a Research Paper (Compilation) by Global Journals Inc. (US)

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Topics	Grades		
	A-B	**C-D**	**E-F**
Abstract	Clear and concise with appropriate content, Correct format. 200 words or below	Unclear summary and no specific data, Incorrect form Above 200 words	No specific data with ambiguous information Above 250 words
Introduction	Containing all background details with clear goal and appropriate details, flow specification, no grammar and spelling mistake, well organized sentence and paragraph, reference cited	Unclear and confusing data, appropriate format, grammar and spelling errors with unorganized matter	Out of place depth and content, hazy format
Methods and Procedures	Clear and to the point with well arranged paragraph, precision and accuracy of facts and figures, well organized subheads	Difficult to comprehend with embarrassed text, too much explanation but completed	Incorrect and unorganized structure with hazy meaning
Result	Well organized, Clear and specific, Correct units with precision, correct data, well structuring of paragraph, no grammar and spelling mistake	Complete and embarrassed text, difficult to comprehend	Irregular format with wrong facts and figures
Discussion	Well organized, meaningful specification, sound conclusion, logical and concise explanation, highly structured paragraph reference cited	Wordy, unclear conclusion, spurious	Conclusion is not cited, unorganized, difficult to comprehend
References	Complete and correct format, well organized	Beside the point, Incomplete	Wrong format and structuring

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