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ENHANCING THE PROPERTIES OF R.C.C. STRUCTURES AGAINST FIRE

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ABSTRACT:- *Fires are caused out of the blue, energy sources or natural means that, however the bulk of fires in buildings are caused by human error. Once a hearth starts and therefore the contents and/or materials during a building are burning, then the hearth spreads via radiation, convection or physical phenomenon with flames reaching temperatures of between 600°C and 1200°C. Damage is caused by a mix of the consequences of smoke and gases, that are emitted from burning materials, and therefore the effects of flames and high air temperatures. Concrete doesn't burn – it can't be 'set on hearth' like different materials during a building and it doesn't emit any venomous fumes once stricken by fire. It'll additionally not manufacture smoke or drip liquified particles, in contrast to some plastics and metals, thus it doesn't boost the hearth load. For these reasons concrete is claimed to own a high degree of fireside resistance and, within the majority of applications, concrete is delineate as nearly 'fireproof'. This glorious performance is due within the main to concrete's constituent materials (i.e. cement and aggregates) that, once with chemicals combined inside concrete, type a material that is basically inert and, significantly for hearth safety style, features a comparatively poor thermal conduction. it's this slow rate of warmth transfer (conductivity) that allows concrete to act as an efficient hearth defend not solely between adjacent areas, however additionally to guard itself from hearth harm. The speed of increase of temperature through the cross section of a concrete part is comparatively slow so internal zones don't reach constant high temperatures as a surface exposed to flames. a typical ISO 834/BS 476 hearth take a look at on 160 mm wide x 300 mm deep concrete beams has shown that, once one hour of exposure on 3 sides, whereas a temperature of 600°C is reached at 16 mm from the surface, this worth halves to only 300°C at 42 mm from the surface – a gradient of three hundred degrees in regarding an in. of concrete! Even once a protracted amount, the interior temperature of concrete remains comparatively low; this allows it to retain structural capability and hearth shielding properties as a separating part.*

INTRODUCTION

We are all responsive to the harm that fireplace will cause in terms of loss of life, homes and livelihoods. A study of sixteen industrial nations (13 in Europe and the USA, North American country and Japan) found that, during a typical year, the quantity of individuals killed by fires was one to two per 100,000 inhabitants and therefore the total price of fireside harm amounted to 0.2% to 0.3% of GNP. Within the USA specifically, statistics collected by the National hearth Protection Association (USA) for the year 2000 showed that quite 4,000 deaths, over 100,000 injuries and quite $10bn of property harm were caused by hearth. Great Britain statistics counsel that of the 500,000 fires once a year attended by firefighters, regarding one third occur in occupied buildings and these end in around 600 fatalities (almost all of that happen in dwellings). The loss of business ensuing from fires in business and workplace buildings runs into many pounds every year. The extent of such harm depends on variety of things like building style and use, structural performance, hearth termination devices and evacuation procedures. Though hearth safety standards are written with this categorical purpose, it's intelligibly the security of individuals that assumes the bigger importance. Applicable style and selection of materials is crucial in guaranteeing hearth safe construction. Codes and laws a fire safety are updated regularly, sometimes as a results of analysis and development.

An original methodology s illustrated for assessing the hearth harm to reinforced-concrete buildings by Pietro Croce et al. Microstructure of fireside broken concrete is investigated by Wei Lin et al [47] by victimisation scanning negatron magnifier and stereo magnifier for the concrete that has been heated to a temperature of 900°C to induce the visual data that may} well be not possible to visualize with the eye will facilitate to grasp the behavior of concrete in hearth. A case of assessment of the structure of Novi unhappy Open was given by R. Folic et al . Strength and sturdiness recovery of fireside broken concrete once post-fire- activity was given by Chi-Sun poon et al in 2001. M. A. Riley from Sir William Halcrow & partners Ltd has given a ape on potential new methodology for the assessment of fire-damaged concrete . N. R. Short et al worked within the space of assessment of fireside broken concrete victimisation color image analysis. The effects of speedy cooling by water ending on the stiffness properties of fire-damaged concrete was studied by A. Y Nassif et al of Londan University within the year 1999.

***CRITERIA FOR DAMAGE CLASSIFICATION*:**

Class of Damage	Repair classification	Repair Requirements
Class 1	Superficial	For repair, use cement mortar trowelling using cement slurry bonding
Class 2	General	Non-structural or minor structural repairs like restoring cover to reinforcement using cement polymer slurry as bonding layer and nominal light fabric reinforcement or using epoxy mortar over the primary coat of epoxy primer. No fabric for small patches of area less than 0.09 sq.m
Class 3	Principal Repair	Where concrete strength is significantly reduced, strengthening to be carried out with shotcreting in case of slabs and beams and jacking in case of columns. For less damaged columns shotcreting is also proposed. The bonding material used shall be epoxy formulation Additional reinforcement shall be provided in accordance with load carrying requirement of the member. Both residual and final strength to be checked by design procedure.
Class 4	Major repair	Repair method is demolition

LITERATURE REVIEW

Fire remains one in every of the intense potential risks to most buildings and structures. The intensive use of concrete as a structural material has semiconductor diode to the necessity to completely perceive the impact of fireplace on concrete. Typically concrete is assumed to own smart fireplace resistance. The behavior of ferroconcrete columns below extreme temperature is especially tormented by the strength of the concrete, the changes of fabric property and explosive spalling.
The hardened concrete is dense, homogenized and has a minimum of a similar engineering properties and sturdiness as ancient vibrated concrete. However, high temperatures have an effect on the strength of the concrete by explosive spalling then have an effect on the integrity of the concrete structure.

EXPERIMENTAL WORK

***INTRODUCTION*:** The specimens for testing were Sri TMT bar of 12mm diameter. 54 bars were move 40cm size. 6 Specimens were tested for the mechanical properties victimisation UTM before heating at traditional temp and also the properties were tabulated. 12 specimens every were heated within the electrical chamber at 100°, 300°, 600° associate degreed 900°C for an hour with none disturbance once heating, out of 12 specimens for every temperature 6 samples were quenched in water for speedy cooling and also the different 6 were unbroken aside for traditional cooling at atmospherical temperature. These specimens later were tested for mechanical properties with UTM and microstructure study victimisation SEM.

EQUIPEMENT:

i.) Universal Testing Machine (ii) Scanning Electron Microscope (iii) Electrical Furnace

RESULTS FROM COMPUTERIZED UTM:

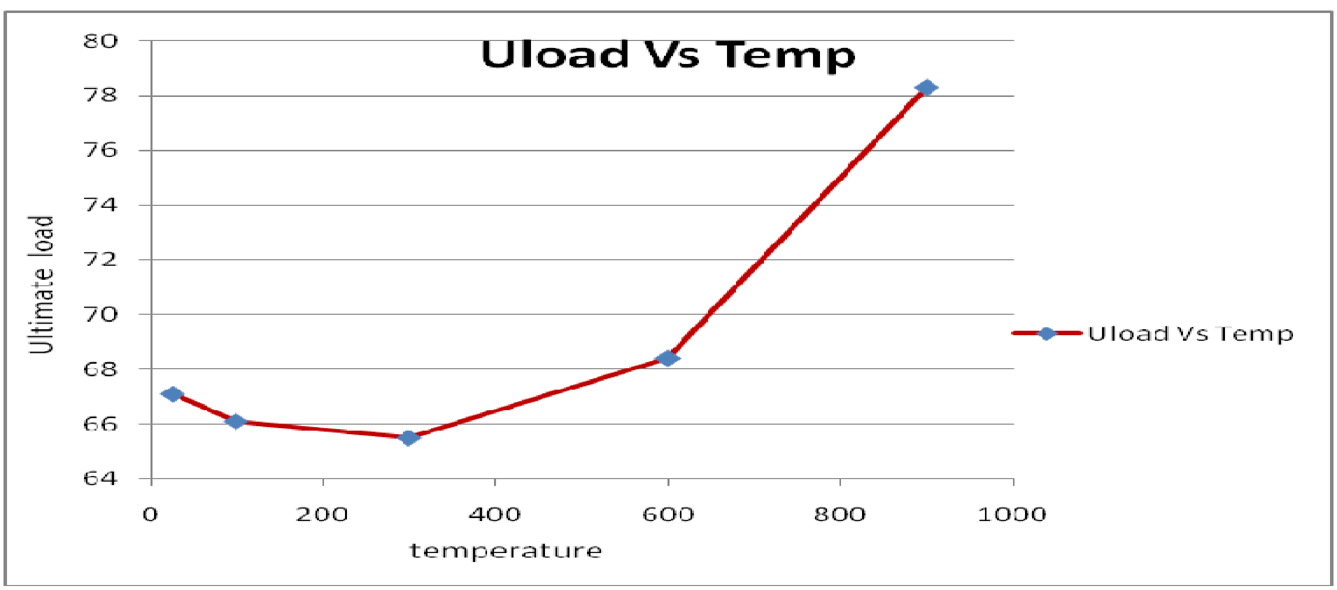
Table1: Properties for rapid cooling conditions

S.NO	Temp in ° C	Ultimate load (kN)	Ultimate stress(kN/mm^2)	Yield stress (kN/mm^2)	Max. extension(mm)	Elongation (%)	.2% proof stress
1	27	67.1	0.583	0.466	1.63	28.3	0.465
2	100	66.1	0.584	0.469	1.66	15	0.461
3	300	65.5	0.582	0.451	1.422	30	0.44
4	600	68.4	0.606	0.453	0.972	23.3	0.456
5	900	78.3	0.692	0.469	0.206	11.6	0.534

Table2: Properties for ordinary cooling conditions

S.NO	Temp in ° C	Ultimate load (kN)	Ultimate stress(kN/mm^2)	Yield stress (kN/mm^2)	Max. extension(mm)	Elongation (%	.2%proof stress(kN/mm2)
1	27	67.1	0.593	0.466	1.63	28.3	0.465
2	100	66.5	0.588	0.448	1.139	30.2	0.455
3	300	63.7	0.571	0.436	1.12	28.3	0.429
4	600	64.3	0.574	0.484	0.76	27.45	0.449
5	900	65.5	0.585	0.465	0.62	26.6	0.437

For RAPID cooling conditions: **Fig 1: Temperature vs ultimate load**



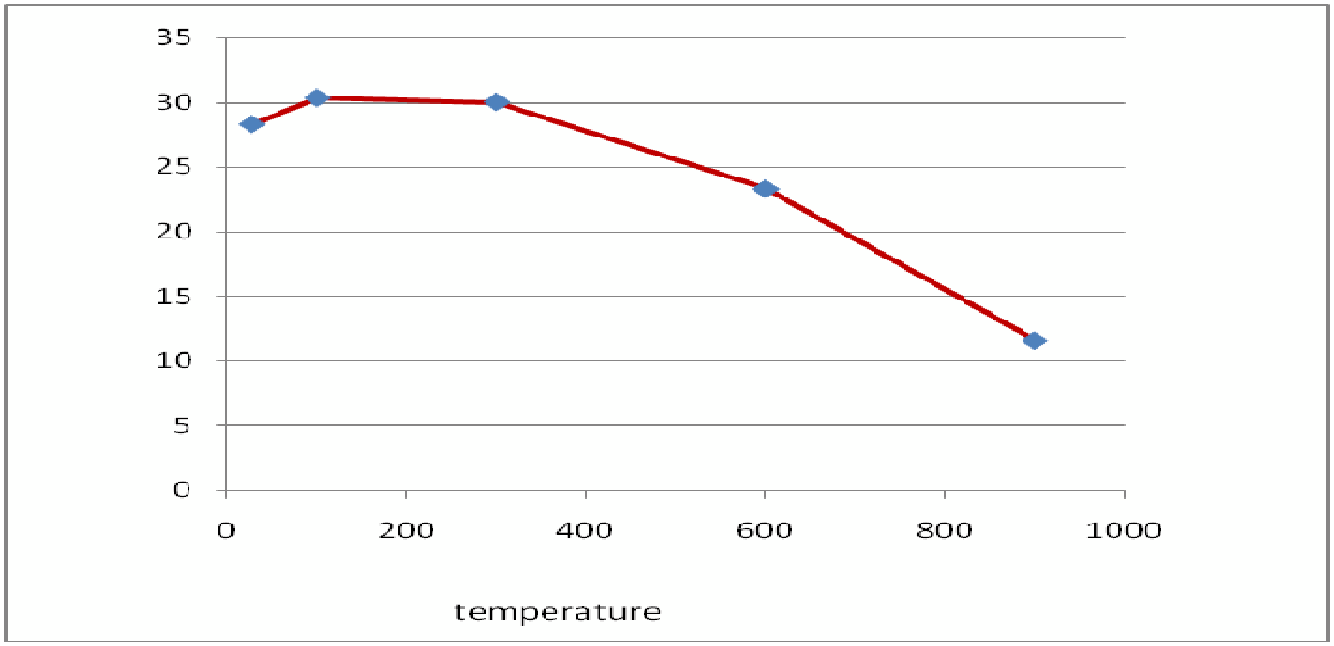


Fig 2: Temperature vs % Elongation

From the Fig2. it can be observed that the ultimate stress initially decreases and then gradually increases, with increase in temperature, this happens due to the microstructure of the bar. For high temperatures the grain size decereases.

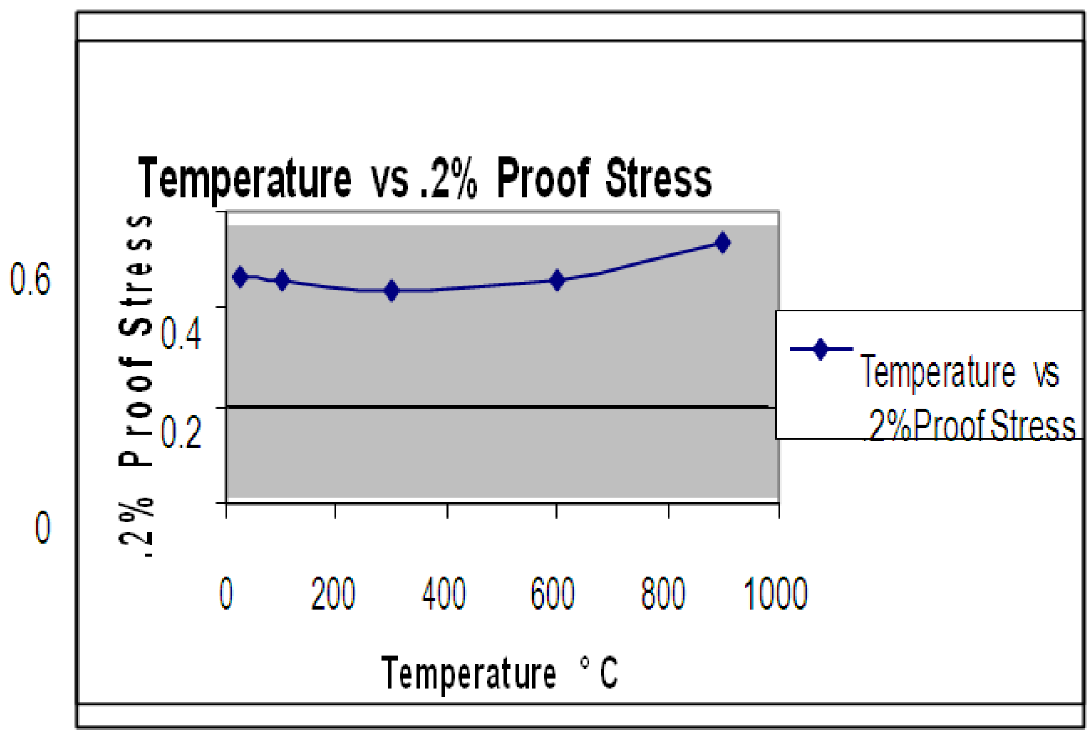


Fig3: %Proff stress vs temperature

From the Fig3. it can be observed that the proof stress initially constant then decreases and then gradually increases, while we increases the temperature.

For ordinary cooling conditions from table 2:

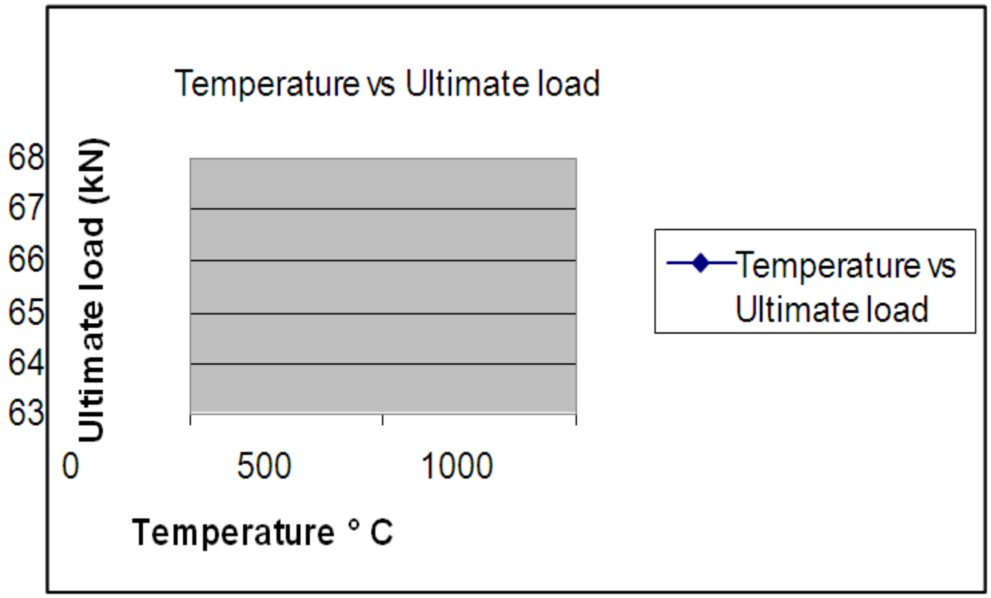


Fig4: Temperature vs Ultimate load

From the Fig4, the ultimate load carrying capacity of the specimen was reduced in the specimen before heating.

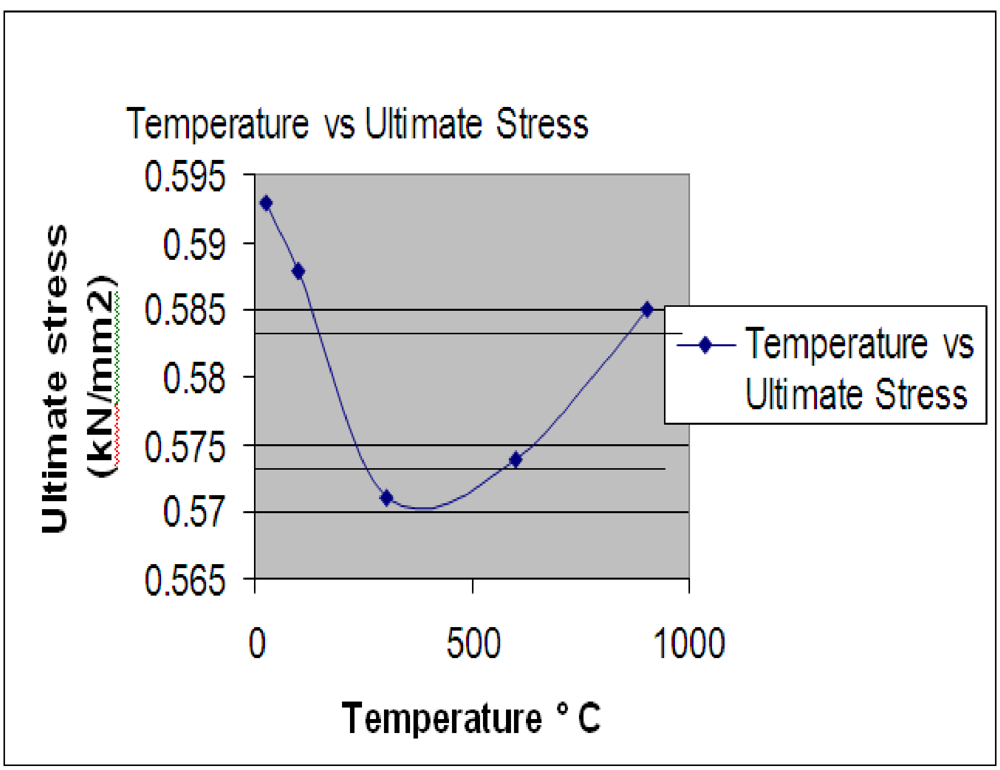


Fig5: Temperature vs Ultimate stress

From the Fig5. it can be observed that the ultimate stress initially decreases and then gradually increases, with increase in temperature, this happens due to the microstructure of the bar.

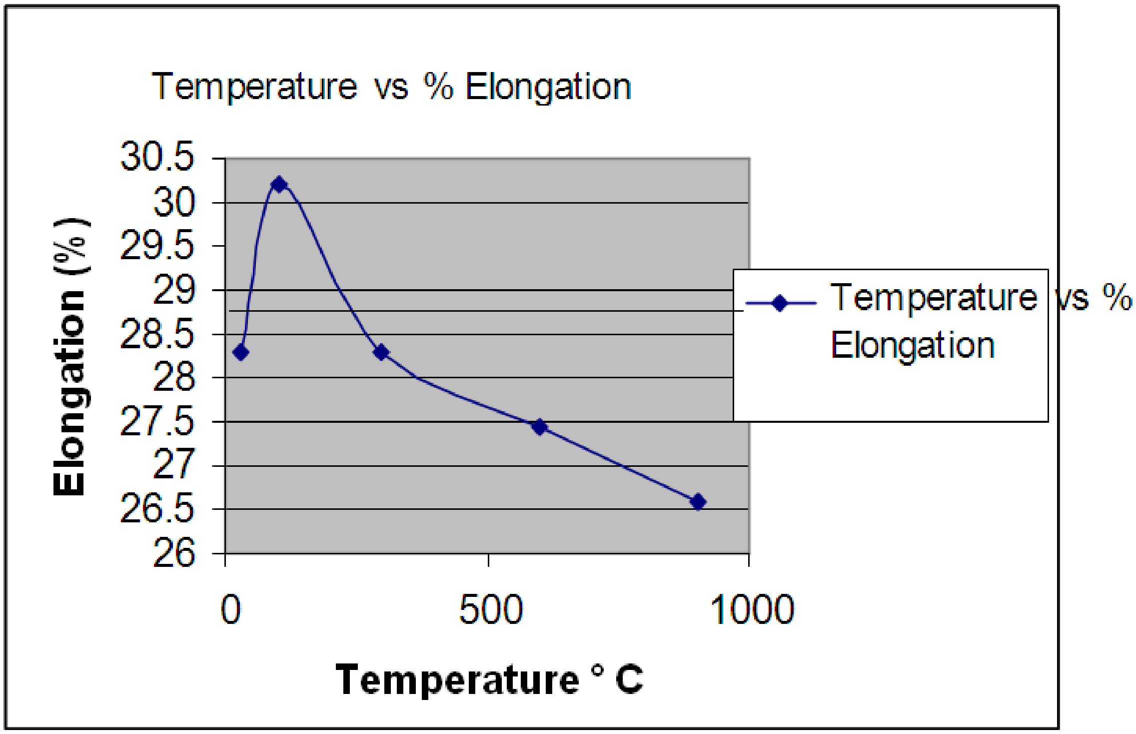


Fig6 : Temperature vs % Elongation

From the Fig6. it can be observed that the % Elongation initially increases upto a point and then gradually decreases. For high temperatures the grain size decereases.

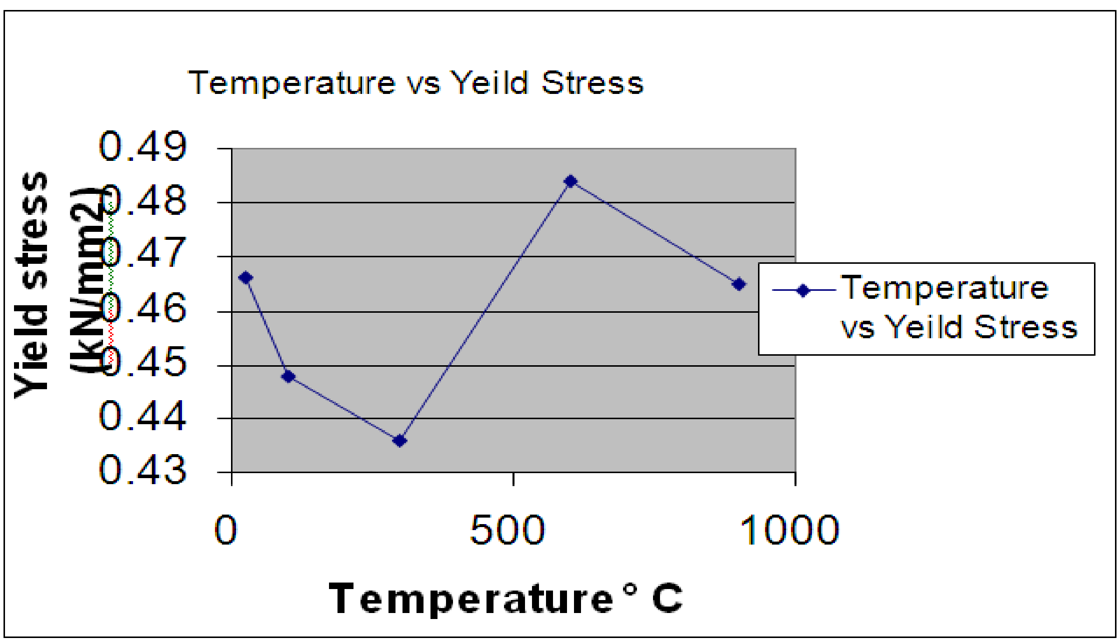


Fig7: Temperature vs Yield Stress

In fig7 it shows the variation between temperature and yield stress in which the yield stress first decreases then suddenly increases upto certain limit after which decreases.

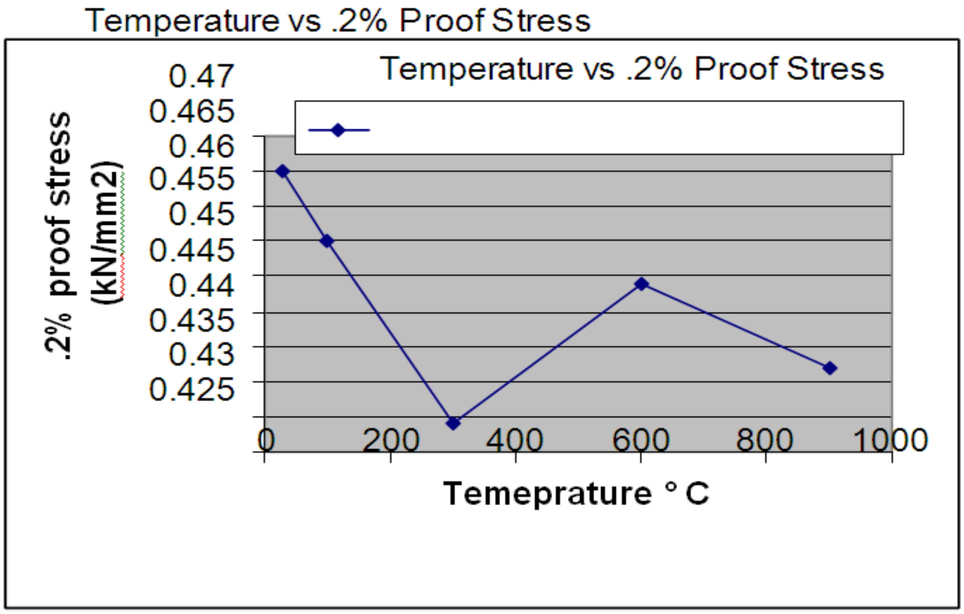


Fig8: Temperature vs .2% Proof stress

In fig8 it shows the variation between temperature and proof stress in which the proof stress first decreases then suddenly increases up to certain limit after which again start decreasing.

CONCLUSION

i.) The impact of fireside on the reinforcement bars heated at numerous temperatures of 100° C 300° C, 600°C, 900° C, cooled quickly by termination in water and usually cooled within the atmospherical temperature were studied and it's ascertained that the plasticity of quickly cooled bars once heating to extreme temperature to 900 ° C.

ii.) Finding out the characteristic changes in the mechanical properties of the bars by enduringness testing victimisation Universal Testing Machine shows that the rise in final load and reduce in proportion elongation of the specimen that mean that there's important decrease in plasticity of the specimen.

iii.) Study of small structure of the bars victimization Scanning electron microscope (SEM) conjointly shows that the microstructure of extremely heated specimens varies while not varied the chemical composition which might have negative impact on the structure.

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