ISSN PRINT 2319 1775 Online 2320 7876

Research paper © 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, Dec 2022

Analysis of Different Properties of Carbon Compounds of Steel and Geopolymer for Different Applications

Souvik Sur, Assistant Professor,
Department of Chemistry, Teerthanker Mahaveer University, Moradabad, Uttar Pradesh, India
Email Id- souviksur@hotmail.com

ABSTRACT: The capacity of a material to withstand power-driven forces when they operate on it is referred to as its strength. Materials' qualities are determined by a variety of factors, including their composition, application area, and structure. The study's goal is to assess and debate the toughness of some of the carbon-containing components researched by various specialists, such as steel compounds and geopolymers. Different specialists concentrate on different elements of materials by conducting numerous tests to achieve suitable findings. According to the study, carbon-containing compounds have great strength and are employed in various sectors of production. The research will aid in enhancing the content of the compounds described to enhance the strength to get high-strength materials with the appropriate stress strain for the planned application. Thus, the research on the strength of various materials will improve, and stress-strain must be addressed while building any element combination.

KEYWORDS: Geopolymer, Machine, Steel, Stress, Strain.

1. INTRODUCTION

The field of element strengths often called material mechanics deals with numerous methods for calculating stress-strain for design features such as columns, shafts, and beams. Materials properties including “Yield Strength”, “Ultimate Tensile Strength”, “Young's modulus”, and “Poisson's ratio” are considered while predicting the behavior of the material under load and its susceptibility to various component failures. The mechanical component's geometrical properties, such as length, thickness, boundary limits, width, and abrupt changes in shape [1]. The theory was developed by investigating the behavior with 1 and 2-dimensional objects, where perceived stress may be thought of as 2D and afterward projected into 3 dimensions to explain material behavior. In structural mechanics, the ability of a substance to sustain a weight without breaking or deforming is known as its strength.

The field of strength of the material is focused on the pressures acting on materials and the failure modes that happen when they do. When a load is given to a mechanical structure on a state basis, internal forces called stresses are created inside the member. Whenever a material's deflection is quantified on a unit basis, the phrase “strain” is used to characterize them. To estimate the member's maximum load, which is dictated by the object's shape and size, the stress strain that develops together within the body must be computed. It is possible to apply radial or rotational loads. To evaluate the degree of tension strain at each point inside the member, systems, and materials of the loads and the player's composition can be employed. The individuals' energies, deformations, and stability may all be estimated if the condition of stress-strain inside the individual is understood [2]–[5].

ISSN PRINT 2319 1775 Online 2320 7876

Research paper © 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, Dec 2022

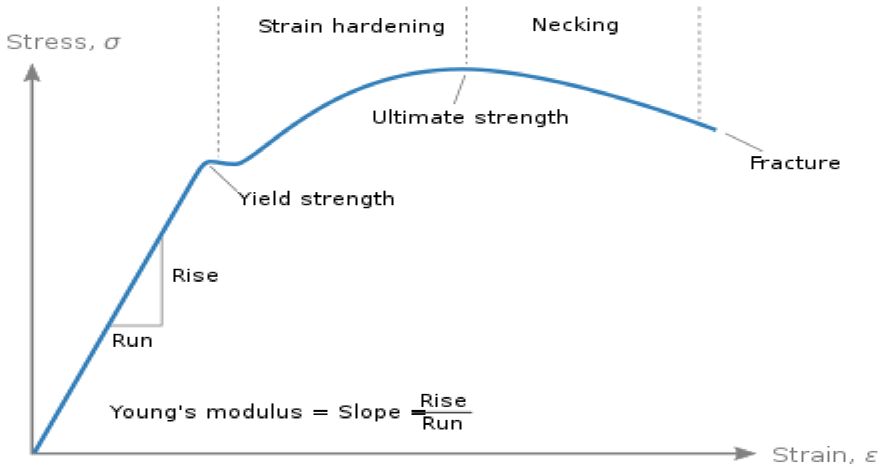

Figure 1: Illustrates the Stress-Strain Curve which is used for Analyzing the Properties of Metals.

Given that the tensile modulus is the parameter that predicts extension in the components, depending on its microstructural properties and intended outcome, one may make intelligent decisions about how to increase the material's strength. The compression, tensile, and shear stress limit values that would cause a collapse are being used to show strength. The consequences of dynamic loading, particularly the problem of fatigue, are arguably the most essential practical aspect of material properties. Brittle fractures are commonly formed as a result of repeated stress, and they expand until they fail. At minimum stress points significantly lesser than the indicated for the material's strength, fractures invariably begin at stress concentrations, notable modifications in the inter-object, around holes and corners.

The different industry experts and researchers studied the properties of materials used in the industry used in various applications. It is always better to know the physical proper of any compounds or materials that are to be used in particular applications to maintain the efficiency of the work. As the studies say different elements are combined with carbon to form the hard compound which may be metal or non-metal. The steel i.e. iron contained compound is used in the manufacturing most of machines and components. The studies made by different experts are useful for designing and developing components by studying the physical and mechanical properties by studying stress and strain. Thus, the study focuses on the new carbon compounds with metals and non-metals to analyze their properties, strengths, and areas of application.

2. DISCUSSION

2.1.Mechanical properties of the material:

Various components, combinations, and metals have unique qualities that distinguish them from one another. When employing a material for any use in industry, its qualities are critical. The point on the architectural stress-strain curve at which the material experiences irreversible deflections that result in permanent member deflection when the pressure is released which shows the effect

ISSN PRINT 2319 1775 Online 2320 7876
Research paper © 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, Dec 2022

of force acting on the bodies from different angles as shown in Figure 1. The material's greatest strength relates to the maximum stress value obtained, whereas fracture toughness relates to the most recent yield stress recorded at the fracture yield point. The properties of metals which are brittleness, bulk modulus, friction coefficient, Poisson's ratio, coefficient of restitution, compressive strength, ductility, malleability, surface roughness, elasticity, flexural strength, fracture toughness, toughness, mass diffusivity, Plasticity, Shear modulus, Fatigue limit, Tensile strength, Shear strength, Stiffness, Viscosity, Hardness, Yield strength, Resilience, and Young's modulus [6]–[9].

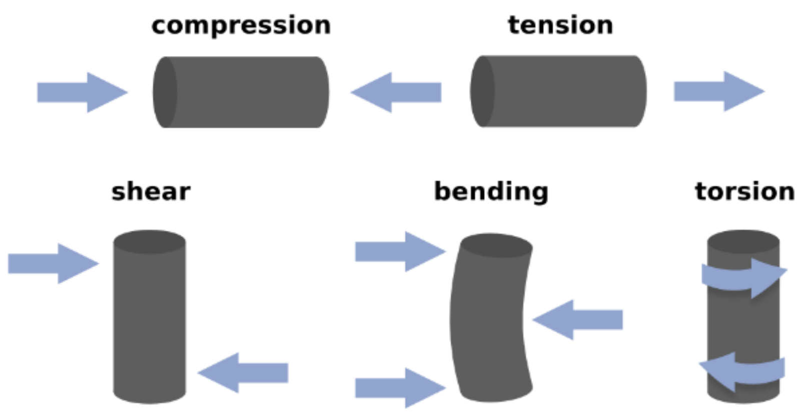

Figure 1: Illustrates the Effect of Forces Acting on the Body which Affects the Physical Properties of Elements. [Source: mechanictips.com]

1.1.Stress parameters:

To depict material resistance, a variety of dynamic load characteristics can be employed. The word "material strength" is describing mechanical stress characteristics, which are parameters that have a consistent pressure-to-force ratio per unit surface size. Mostly as consequence, the standard strength measuring unit in the SI System of Measurement is MPa, but in US metric system it is psi. Strength characteristics include yield point, tensile, wear resistance, fracture resistance, and some other aspects. The yield point is the minimum stress that causes a material to permanently distort. Because the limit of yielding in some materials, such as aluminum alloys, is difficult to determine, it is commonly compressive stress necessary to induce 0.2 percent plastic strain.

- Compressive is a restricted condition of compressed stress crack formation in the form of brittle or ductile fracture.

- Tensile strength, also known as UTS, is a restricted condition of tensile stress that results in tensile failure, either ductile or brittle. Stress can be used to describe tensile strength, although the actual load is the most prevalent.

- Fatigue life seems to be a more complicated measure of a material's strength that takes into account multiple load occurrences throughout an object's service life and is typically more challenging to quantify than standing strengths estimates.

ISSN PRINT 2319 1775 Online 2320 7876

Research paper © 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, Dec 2022

- Hardness value refers to a material's ability to withstand a sudden load applied expressed in terms of energy. To assess this, the "Izod or Charpy impact tests", which both analyze the force strength required to shatter a specimen, are often utilized. The impacting strength of the composite is influenced by its density, young's modulus, gravitational pull, and yield stress.

1.2.Ultimate-strengths:

Ultimate strength is expressed as the pressure applied per unit of area and is a property of a material rather than a specific specimen formed of the material with a unit of Newton per Square meter. The ultimate strength of a material is the highest stress it can bear before breaking or weakening. A design requirement that an engineering element or structure must meet is called a factor of safety. The proportion of UTS to imposed stress is known as the factor of safety.

1.3.Stress-strain relations:

After tension is lifted, elasticity refers to a material's capacity to achieve the proper. The relationship between applied stress and generated strain is exactly proportional in many materials, and a graph expressing those 2 values is a straight line. Plasticity, also known as plastic distortion, is the polar opposite of changeable deformations. Plastic deformation is described as a non-recoverable strain. After the applied force is released, plastic deformation is preserved. Plastic deformation is typically possible with most linear-elastic materials. Material properties, such as porcelain, do not deform permanently and will shatter at minimum force, while ductile material, such as steel, copper, or resins, may flex much more plastically before shattering.

1.4.Material-failure theories:

The four failure theories are "Maximum Strain Energy Theory", "Maximum Distortion Energy Theory", "Maximum Shear Stress Theory", and "Maximum Normal Stress Theory". Only brittle materials would benefit from the "Maximum Normal Stress Theory", whereas ductile materials would benefit from the other three theories. Out of the three, the distortion energy theory produces the most accurate results in the bulk of recommendations based. The "Strain Energy Theory" requires the value of the component material's Poisson's ratio, which is frequently unavailable. The hypothesis of maximum shear stress is conservative. All theories are comparable for simple directional applied stress, which implies they all produce the same outcome.

The microstructure of a substance determines its strength. The microstructure of a material can be altered by the engineering operations it undergoes. Work hardened, crystalline reinforcing, precipitation hardening, and intergranular hardening are examples of restoration hardware that may be statistically and qualitatively described to change the strength of a material. To make the providing quality, strengthening processes come with the proviso that some other material properties of the substance may degrade. In intergranular strengthening, for example, while yield strength increases as grain size decreases, extremely tiny grain sizes eventually cause the material to become brittle. In general, a material's yield point is an adequate predictor of its mechanical strength [10]–[12].

ISSN PRINT 2319 1775 Online 2320 7876

Research paper © 2012 IJFANS. All Rights Reserved, UGC CARE Listed (Group -I) Journal Volume 11, Iss 12, Dec 2022

3. CONCLUSION

The analysis and discussion of the strength of several carbon-containing materials, such as steel compounds and geopolymers, which have lately been the subject of studies by many specialists, was the study's main goal. To get the most pertinent findings, several tests are conducted by the various experts to focus on various materials' features. The study aids in enhancing the composition of chemicals mentioned to increase strength in order to produce high-strength materials with the necessary stress and strain for the intended application. When analysing a material's strength, stress and strain are crucial factors. Natural elements have a variety of qualities, and studying materials may assist determine an element's mechanical and physical characteristics. Thus, it can be said that the study of the strength of different materials will improve and stress-strain should be considered while forming any element compound.

REFERENCES:

[1] T. Zhu and J. Li, "Ultra-strength materials," *Progress in Materials Science*. 2010. doi: 10.1016/j.pmatsci.2010.04.001.

[2] H. Keleş and M. Keleş, "Adsorption and anticorrosion behaviour of an imine compound on low carbon steel in HCl solution at different potentials," *J. Adhes. Sci. Technol.*, 2018, doi: 10.1080/01694243.2017.1363348.

[3] A. S. Fouda, M. A. El-morsi, M. Gaber, and M. Fakeeh, "Azo compounds as green corrosion inhibitor for carbon steel in hydrochloric acid solution: Corrosion inhibition and thermodynamic parameters," *Int. J. Electrochem. Sci.*, 2017, doi: 10.20964/2017.09.33.

[4] M. Galai *et al.*, "Anti-corrosion properties of some triphenylimidazole substituted compounds in corrosion inhibition of carbon steel in 1.0 M hydrochloric acid solution," *Anal. Bioanal. Electrochem.*, 2017.

[5] M. A. Deyab, A. S. Fouda, M. M. Osman, and S. Abdel-Fattah, "Mitigation of acid corrosion on carbon steel by novel pyrazolone derivatives," *RSC Adv.*, 2017, doi: 10.1039/c7ra08761f.

[6] K. H. Song and K. Nakata, "Mechanical properties of friction-stir-welded inconel 625 alloy," *Mater. Trans.*, 2009, doi: 10.2320/matertrans.M2009200.

[7] S. Vytejčková *et al.*, "Testing of polybutylene succinate based films for poultry meat packaging," *Polym. Test.*, 2017, doi: 10.1016/j.polymertesting.2017.04.018.

[8] ASTM, "Standard Specification for Iron-Phosphorus Powder Metallurgy (P / M) Parts for Soft," *Astm*, 2015.

[9] P. A. M. dos Santos, A. V. Priebbnow, S. Arcaro, R. M. da Silva, D. A. Rodriguez Lopez, and A. de Assis Lawisch Rodriguez, "Sustainable glass foams produced from glass bottles and tobacco residue," *Mater. Res.*, 2018, doi: 10.1590/1980-5373-MR-2018-0452.

[10] F. Nakamori, Y. Ohishi, H. Muta, K. Kurosaki, K. ichi Fukumoto, and S. Yamanaka, "Mechanical and thermal properties of ZrSiO4," *J. Nucl. Sci. Technol.*, 2017, doi: 10.1080/00223131.2017.1359117.

[11] J. Lequieu, A. Córdoba, D. Hinckley, and J. J. De Pablo, "Mechanical response of DNA-nanoparticle crystals to controlled deformation," *ACS Cent. Sci.*, 2016, doi: 10.1021/acscentsci.6b00170.

[12] X. Huang, F. Xie, and X. Xiong, "Surface-modified microcrystalline cellulose for reinforcement of chitosan film," *Carbohydr. Polym.*, 2018, doi: 10.1016/j.carbpol.2018.08.085.