© 2016 IJSRSET | Volume 2 | Issue 1 | Print ISSN : 2395-1990 | Online ISSN : 2394-4099
Themed Section: Engineering and Technology

Effect of Specimen Size on Fracture Toughness of Mild Steel Using ANSYS

Niharika Sharma, Dr. Ganesh Doiphode

Faculty of Technology and Engineering, M.S University, Vadodara, Gujarat, India

ABSTRACT

In this paper effective of specimen size on fracture toughness of mild steel is calculated based on ANSYS 16.0. Most engineering components and structures subjected to repeated fluctuating load cycles due to which it contain some form of stress raisers that results from geometrical or metallurgical discontinuities. In most of the cases such components fail due to the phenomenon known as fatigue. Fracture toughness is an indication of the amount of stress required to propagate a pre-existing flaw. It is a very important material property since the occurrence of flaws is not completely avoidable in the processing, fabrication, service of a material or component.

Keywords: Iris Recognition, Visual Cryptography, Segmentation, Localisation, Visual Cryptography, Log Gaber Wavelet

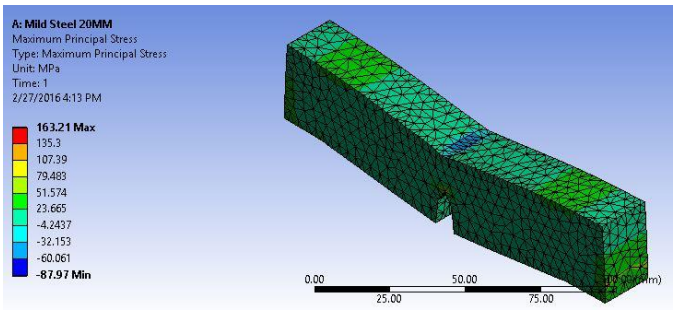
I. INTRODUCTION

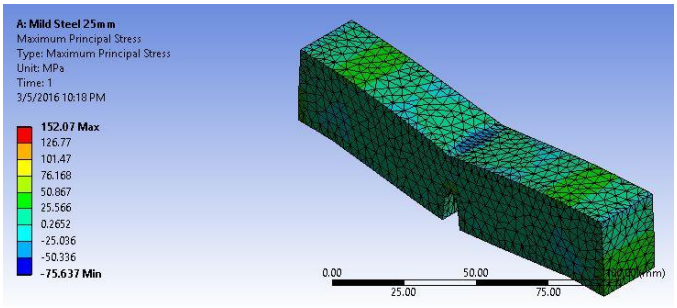
Fracture mechanics is a branch that deals with the study of propagation of cracks in materials and it plays an important role in designing especially for the components which are light weight and are subjected to high amount of loading and various amount of stresses. Steel is one of the major inventions that have helped mankind progress by leaps and bounds in many spheres. It is one of the most used and reused alloys in present scenario. Steel is now available in many grades and specifications. Mild Steel is essentially a form of Carbon Steel that has low Carbon content which imparts the steel in many physical and mechanical properties. It is used extensively for many Industrial applications including structural applications and constructions because of their properties. The material properties and mechanical characteristics of Mild Steel are crucial in deciding the area of application. These properties of the Mild Steel are determined by a series of tests. The popularity of mild steel in many industries is mainly because the material is easy to work with. The physical property of the mild steel is high malleability due to the low carbon content. Hence it can be moulded in any form. This property enables the mild steel to be formed into bars. Mild steel also have high ductility that implies the steel can be bent into any shape or form without breaking.

II. METHODS AND MATERIAL

A. Why Mild Steel?

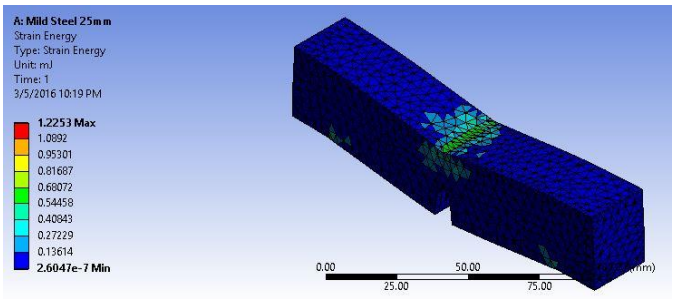
In present scenario mild steel plays a very important material almost everywhere as it carries more load with less structural dimensions. The Strength of Steel per unit volume is high compared to concrete which will lead to lesser cross section dimensions and lesser dead weight. This will be advantageous for multi storey buildings and for structures resisting on weak soil Ductility is the property by virtue of which steel undergoes large deformation before failure due to these steel structures mostly do not fail suddenly.

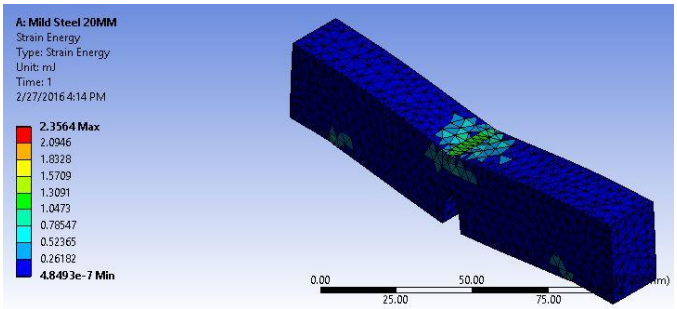




B. Procedure

CAD drawings were formed for the shape of three point bend specimen with V notch of size wrt code ASTM 1820 and ASTM 399, were 150mm X 30mm X 20mm and 150mm X 30mm X 25mm here variation in thickness were done with width to crack ratio as (a/w) 0.5 as per codal provisions and were imported to ANSYS then it was modeled with and same amount of loading was applied which is 21kN. This load limit was calculated experimentally on MTS testing machine.





C. Literature Review

E 1820 – 99aStandard Test Method for Measurement of Fracture Toughness This standard is issued under the fixed designation E 1820; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (e) indicates an editorial change since the last revision or reapproval.

E 399 – 90 (Reapproved 1997) Standard Test Method for Plane-Strain Fracture Toughness of Metallic MaterialsThis standard is issued under the fixed designation E 399; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (e) indicates an editorial change since the last revision or reapproval.This standard has been approved for use by agencies of the Department of Defense.

Rostand Moutou Pitti · Claudiu Badulescu The crack characterization in a pre-cracked aluminum specimen is investigated in this study using the grid method. The images of this grid are analyzed to provide the crack tip location as well as the displacement and strain fields on the surface of the specimen during a tensile test. Experimental data are used to calculate thee energy release rate with the compliance method.

Anderson, T. L. (1995). Fracture Mechanics, Fundamentals and Applications, CRC Press. ANSYS (1995). With its combination of practicality, readability, and rigor that is characteristic of any truly authoritative reference and text, Fracture Mechanics: Fundamentals and Applications quickly established itself as the most comprehensive guide to fracture mechanics available.

Structural Analysis, Fracture Mechanics Ansys User manual. Manual which helps us to understand the software in more simple way with step wise procedure that allows us to use Ansys with less complications.

III. RESULTS AND DISCUSSION

1. It can be seen clearly that stresses taken by 20mm specimen is more than 25mm specimen for the same amount of loading.
2. Strain Energy for 25mm is less than that of 20mm.
3. Maximum Principle stresses were observed more in 20mm.
4. Also Fracture toughness parameter Stress intensity factor Kic for Mode I and Mode II was compared. Hence we can say that lesser is the surface area lesser are the chances of this material to fail this is

why with respect to fracture scenario lesser thickness is preferred.

IV. CONCLUSION

Most of the research work carried out was mostly only aluminium and brittle materials like concrete. Whereas Steel Structure plays most important role in today's scenario. From this study we can conclude that lesser is the thickness used lesser are the chances of it to undergo fatigue failure and more stresses can be taken by thin material because of its fracture toughness property.

V. REFERENCES

[1] Anderson, T. L. (1995). Fracture Mechanics, Fundamentals and Applications, CRC Press. ANSYS (1995).

[2] Structural Analysis, Section 3.9- Fracture Mechanics Ansys User manual.

[3] ASTM (1999). Annual Book of ASTM Standards. E-399 Standard Test Method for Plane-Strain Fracture Toughness of Metallic Material West Conshohocken, PA, American Society for Testing and Materials. v. 3.01.

[4] E 1820 – 99a Standard Test Method for Measurement of Fracture Toughness

[5] Rostand Moutou Pitti • Claudiu Badulescu • Michel Grédiac Characterization of a cracked specimen with full-field measurements: direct determination of the crack tip and energy release rate calculation

VI. AUTHOR'S PROFILE

Niharika Sharma has received her Bachelor of Engineering degree in Civil Engineering Faculty of Technology and Engineering, M.S University, Vadodara in the year 2013. At present she is pursuing M.Tech. with the specialization of Fracture Mechanics from Faculty of Technology and Engineering, M.S University Vadodara..