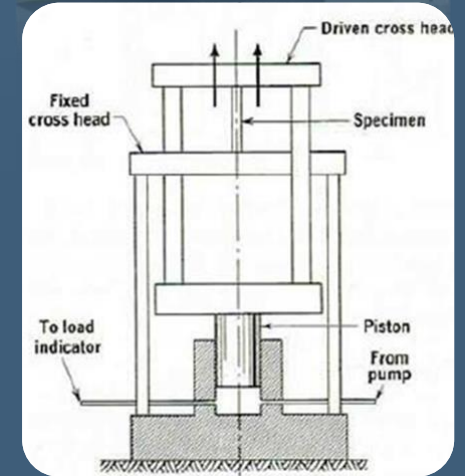
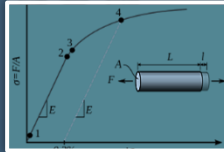
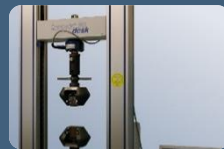
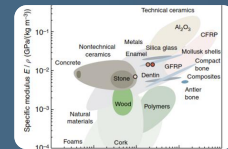


Swathy JR
Instrumental Presentation
IITM

Universal testing machine

UTM





Why UTM?

1

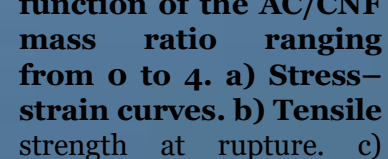
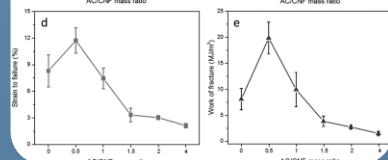
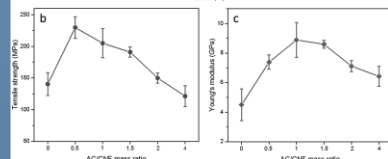
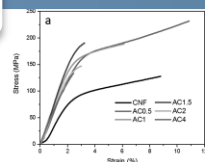


Figure 5. Mechanical properties of AC-CNF hybrid films as a function of the AC/CNF mass ratio ranging from 0 to 4. a) Stress-strain curves. b) Tensile strength at rupture. c) Young's modulus. d) Strain to failure. e) Works of fracture. All measurements were performed at 50% relative humidity and 25 °C, at a strain rate of 1 mm min⁻¹.

2

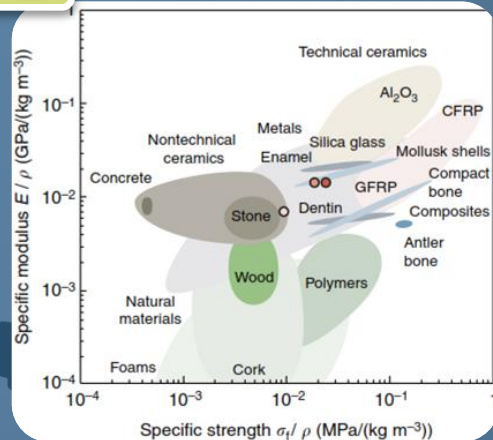


Figure 4. Mechanical properties of nanovaterite compacts. Ashby diagram displaying the specific modulus and specific compressive strength of the nanovaterite compacts in comparison to other man-made and biomineralized materials. Data for the nanovaterite materials are indicated by red, orange and pink circles.

3

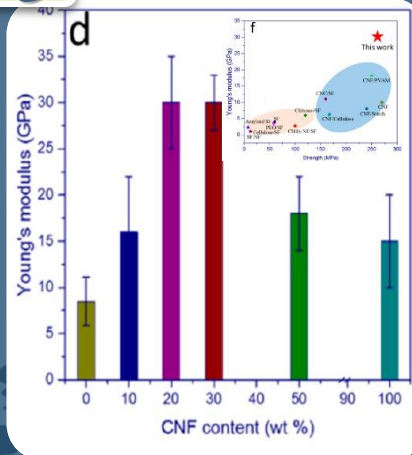


Figure 4. Micromechanical properties of silk-CNF membranes. (d) Young's modulus and (e) ultimate strength of SF-CNF membranes with different CNF content. (f) Comparison of Young's modulus and strength of SF-CNF membranes with other reported nanocomposites films containing CNF or SF materials; yellow region mainly contains SF based materials and blue region mainly contains CNF materials.

4

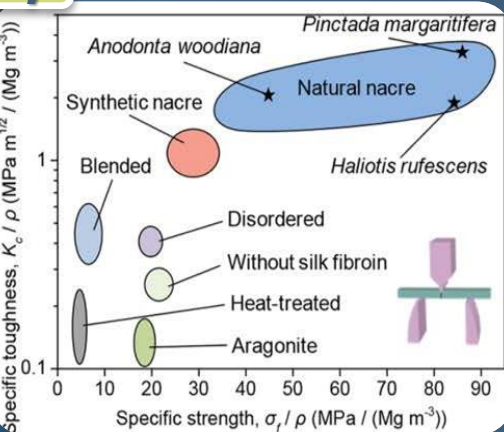


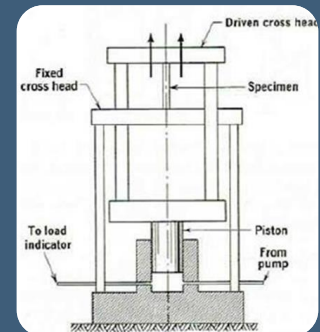
Fig. 4. Mechanical properties of the synthetic nacre. (B) Specific fracture toughness versus specific ultimate flexural strength, illustrating the mechanical performance of the synthetic nacre, natural nacre, pure aragonite and their related materials

1. Liu, Yingxin, Shu-Hong Yu, and Lennart Bergström. "Transparent and Flexible Nacre-Like Hybrid Films of Aminoclays and Carboxylated Cellulose Nanofibrils." *Advanced Functional Materials* (2017).
2. Bouville, Florian, and André R. Studart. "Geologically-inspired strong bulk ceramics made with water at room temperature." *Nature communications* 8 (2017): 14655.
3. Xiong, Rui, et al. "Template-Guided Assembly of Silk Fibroin on Cellulose Nanofibers for Robust Nanostructures with Ultrafast Water Transport." *ACS nano* 11.12 (2017): 12008-12019.
4. Mao, Li-Bo, et al. "Synthetic nacre by predesigned matrix-directed mineralization." *Science* 354.6308 (2016): 107-110.

UNIVERSAL TESTING MACHINE (UTM)

- A **universal testing machine (UTM)**, also known as a **universal tester**.
- Is used to test :
 - *Tensile strength*
 - *Compression test*
 - *Shear strength*
 - *Bend test*
 - *Fatigue test*

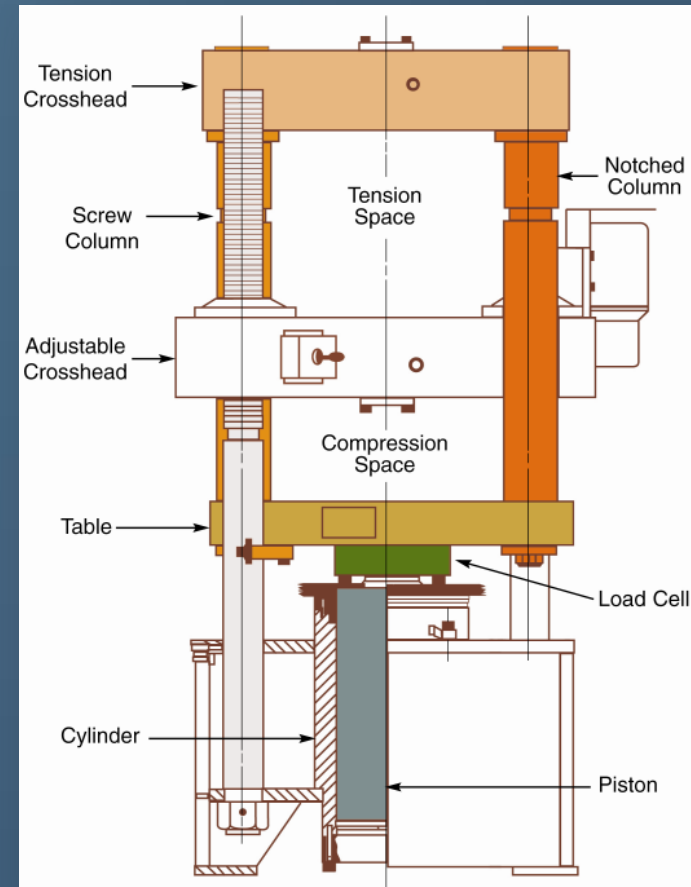
of materials.



The "universal" part of the name reflects that it can perform *many standard tensile and compression tests* on materials, components, and structures. In other words, it is **versatile**.

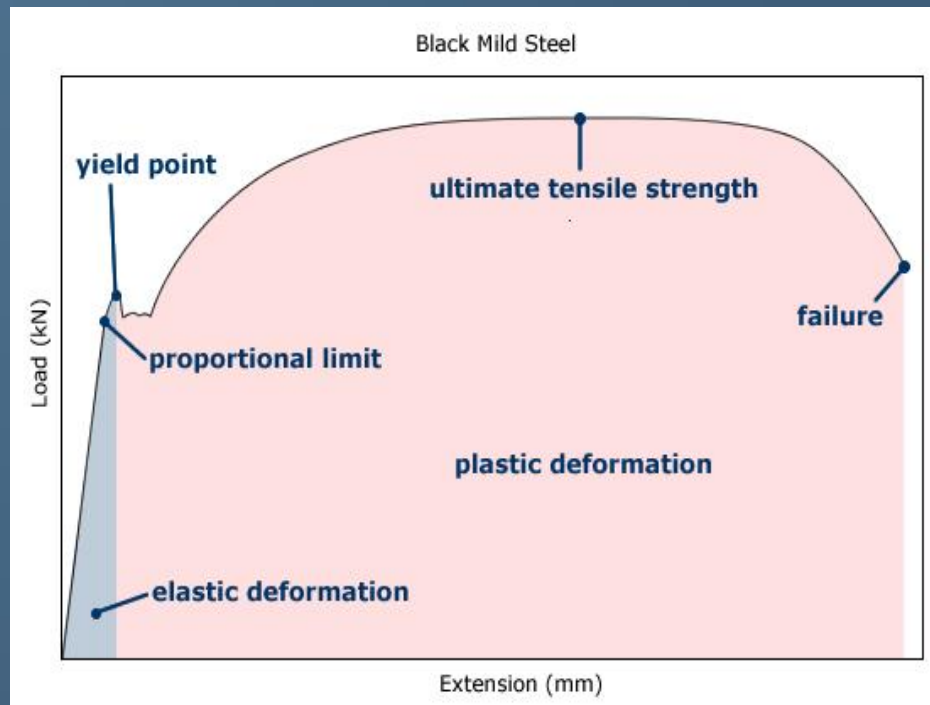
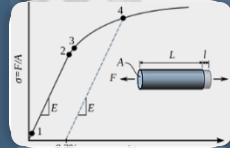
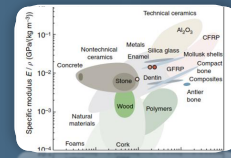
Components

Load frame	Usually consisting of two strong supports for the machine.
Load cell	A force transducer or other means of measuring the load is required.
Cross head	A movable cross head (crosshead) is controlled to move up or down.
Means of measuring extension or deformation	Many tests require a measure of the response of the test specimen to the movement of the cross head. Extensometers are sometimes used.
Output device	A means of providing the test result is needed. Many newer machines have a computer interface for analysis and printing.
Conditioning	Many tests require controlled conditioning (temperature, humidity, pressure, etc.).
Test fixtures, specimen holding jaws, and related sample making equipment are called for in many test methods	



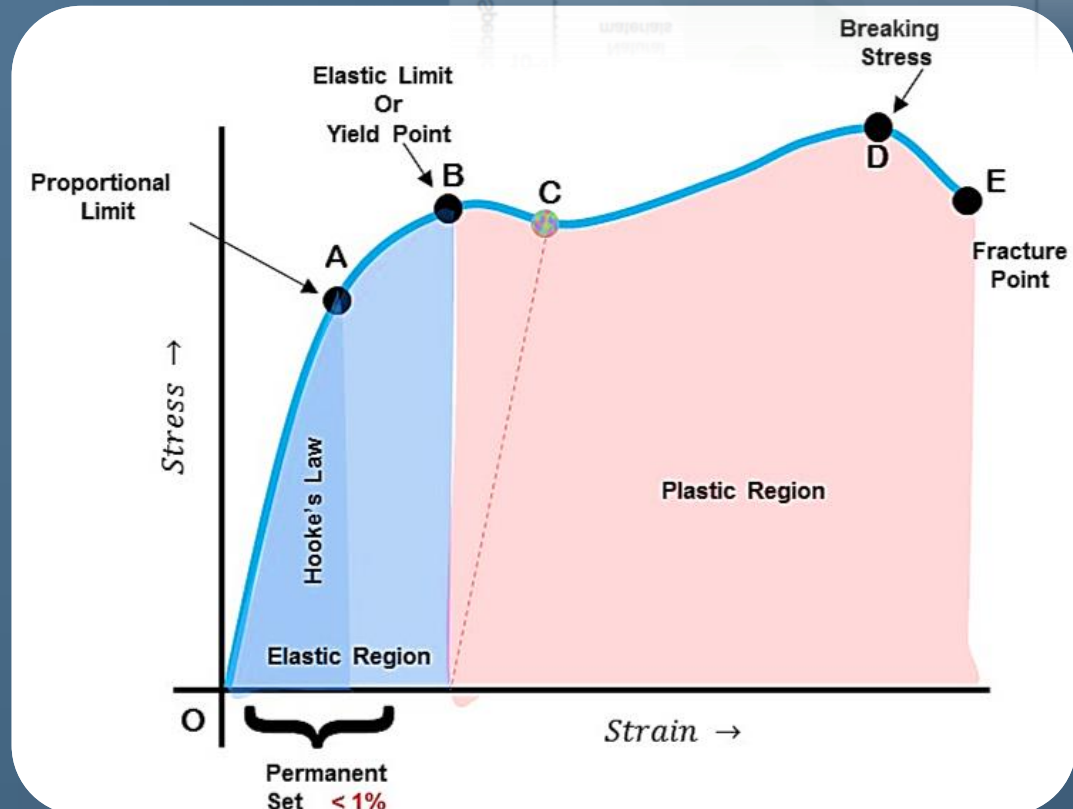
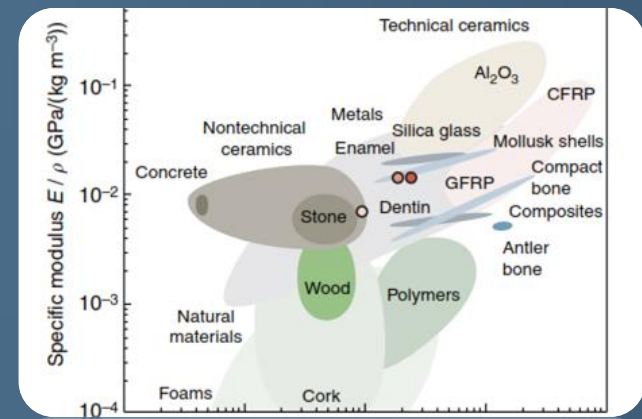
Load extension graph

- Elastic deformation
- Proportionality limit
- Yield point
- Tensile strength
- Failure



Young's modulus

- Young's modulus, also known as the elastic modulus, is a measure of the stiffness of a solid material.
- It defines the relationship between stress (force per unit area) and strain (proportional deformation) in a material.

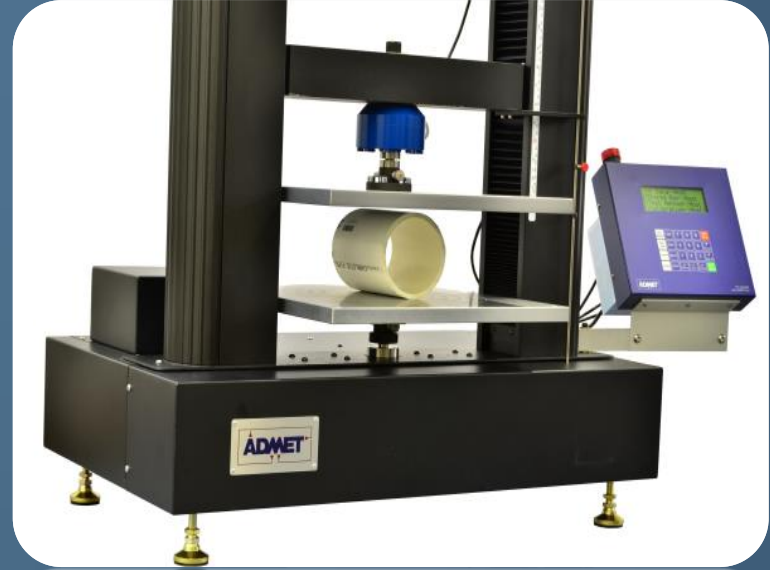


Overview

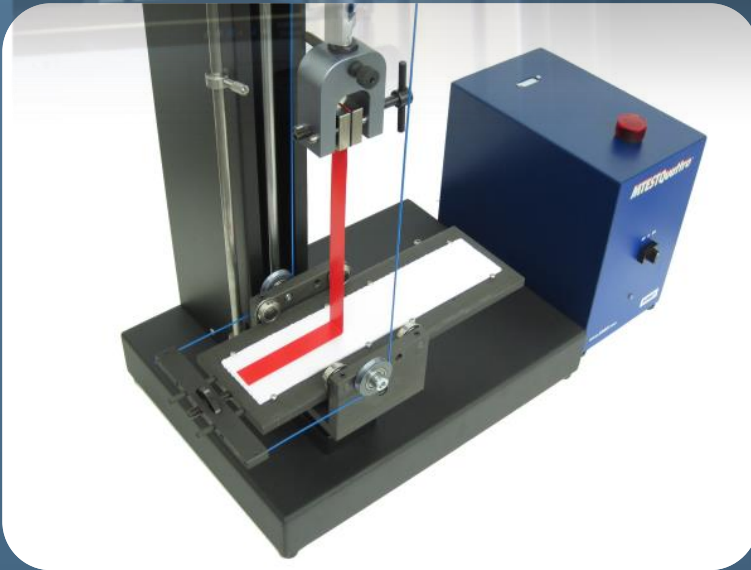
Tensile strength



Compressive Test



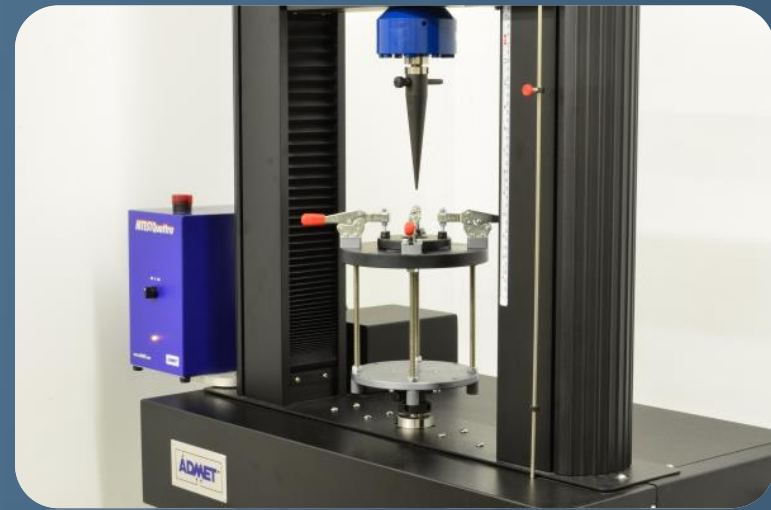
Peel Test



Bend Test



Resources



Puncture test

- <http://concretecivil.com/universal-testing-machine-and-components-of-utm/>
- <https://www.admet.com/what-is-a-universal-testing-machine-2/>
- Davis, Joseph R. (2004), Tensile testing (2nd ed.), ASM International, p. 2, ISBN 978-0-87170-806-9.
- Annappa, C H (July 2012), "APPLICATION OF VALUE ENGINEERING FOR COST REDUCTION – A CASE STUDY OF UNIVERSAL TESTING MACHINE" (PDF), International Journal of Advances in Engineering & Technology, 4 (1): 618–629, retrieved 1 December 2017

Thank You