Technion-Israel Institute of Technology
Faculty of Mechanical Engineering

הטכניון-מכון טכנולוגי לישראל
הפקולטה להנדסת מכונות

סמינריון

הנך מוזמן/ת להרצאה סמינריונית של הפקולטה להנדסת מכונות, שתתקיים ביום ב' 5.02.2018 (כ' בשבט, תשע"ח), בניין דן קאהן, אודיטוריום 1, 14:30.

מרצה: יהלי ברק

מנחה: פרופ"מ שמוליק אוסובסקי

על הנושא:

CORRELATING FRACTURE SURFACE ROUGHNESS AND FRACTURE TOUGHNESS UNDER VARYING LOADING RATES

The seminar will be given in Hebrew

להלן תקציר ההרצאה:

The process by which ductile materials fail is governed by the nucleation, growth and coalescence of micron-sized voids, accompanied by large plastic deformation. This process results in a highly irregular fracture surface, which was revealed by Mandelbrot et. al. to be a fractal. This observation has spurred a series of works hoping to correlate the fracture surface roughness with the material's resistance to crack growth (fracture toughness), via the scaling exponent characterizing the surface scale invariance properties. Unfortunately, this hope has remained unfulfilled with different papers reporting positive, negative or no correlation.

Studies held by Bouchaud have demonstrated that in fact, the value of the roughness exponent is not only independent on the fracture toughness but also of the material under question, as long as the fracture mechanism is not changed. The universality demonstrated, is intriguing and has sparked a lot of theoretical works aiming at understanding its origin. However, from an engineering perspective it renders the usage of fracture surface roughness rather useless as a tool for performing quantitative fractography.

Here we show, that by going beyond the universal value of the scaling exponent, namely, looking the length scale at which the scaling relation breaks, a clear correlation is found between the material's fracture toughness and the fracture surface roughness. A series of fracture tests on 6061-T6 Aluminum alloy is conducted at varying loading rates and the fracture toughness is shown to be dependent on the loading rate. Using a stereo pair of SEM images we construct the digital elevation maps from the fractured surfaces and the extracted correlation length-scales are shown to correlate linearly with the measured fracture toughness. The work presented here, revives the hope of using the statistics of the fracture surface for automated quantitate assessment of the energy required to fracture a material as well as the microstructural features which governs the fracture process.

בברכה,

פרופ"א מתי סאס
מרכז הסמינרים