

EME International Seminar Series



Extension-shear mixed-mode fracture in rocks: Effects of pore pressure

Hiroko Kitajima

Department of Geology & Geophysics, Texas A&M University

<https://artsci.tamu.edu/geology-geophysics/contact/profiles/hiroko-kitajima.html>

Abstract:

Pore fluid pressure in the geological formation at depth varies spatially and temporally. When pore fluid pressure rises due to natural or anthropogenic processes, it leads to lower normal stress, favoring the formation of open-mode extension fractures or extension-shear hybrid fractures. This study investigates how pore fluid pressure influences extension-shear mixed-mode fractures by conducting triaxial extension deformation experiments on porous Berea sandstone and non-porous Carrara marble under controlled pore-fluid pressure. The results show that Berea sandstone specimens under pore pressure control fracture at lower strengths than dry samples, while Carrara marble fractures at greater strengths in pore pressure-controlled conditions than in dry ones. The difference in fracture strengths between dry and pore-pressure-controlled conditions is especially marked when the effective minimum principal stress is tensile. These findings emphasize that elevated pore pressure dictates extension-shear fracture formation through microscopic deformation mechanisms, such as dilatancy hardening and subcritical crack growth, which are strongly influenced by rock type and properties like porosity and permeability.

Thursday, 11 June 2026 16:00 – 17:00, 3F400

Degree Program in Engineering Mechanics and Energy
<https://www.eme.tsukuba.ac.jp/eme-international-seminar-series>