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Multiscale Mechanics on Advanced Materials

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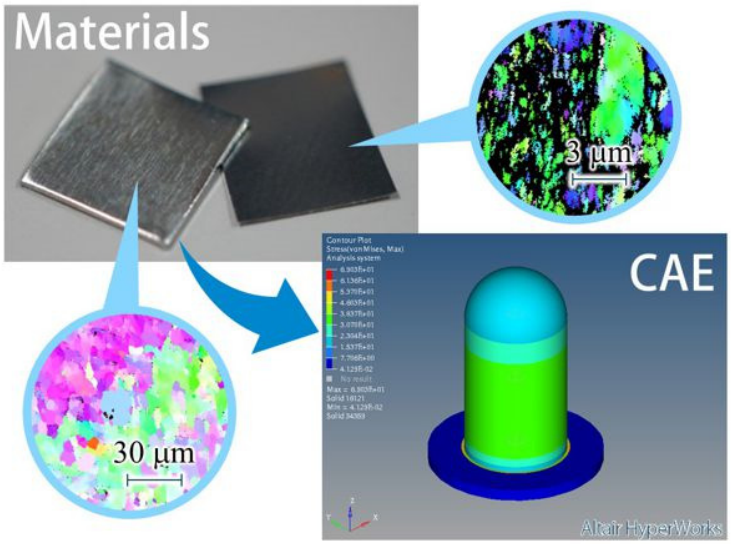
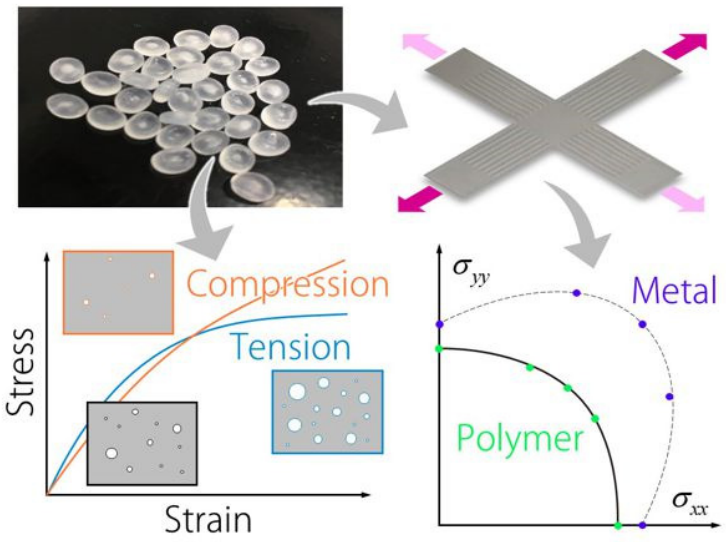
Prediction of Mechanical Properties of UFGMs



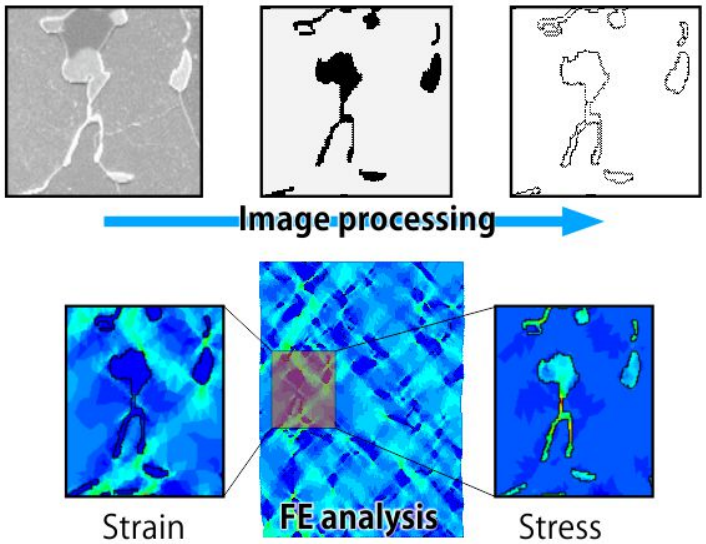
Recently, industrial demand for materials has been much higher. Many researchers have focused on ultrafine-grained metal (UFGM) manufactured by severe plastic deformation. UFGM is a metallic material with a mean crystal grain size of 1 micrometer or less; however mechanical response is still unclear. In this research, we predict high reliable yield function by comparing numerical simulation considering the microstructure of metals with experimental observations. In addition, we aim to perform seamlessly design, development, and practical application using CAE on structural analysis.

Mechanical Anisotropy of Thermoplastic Polymers



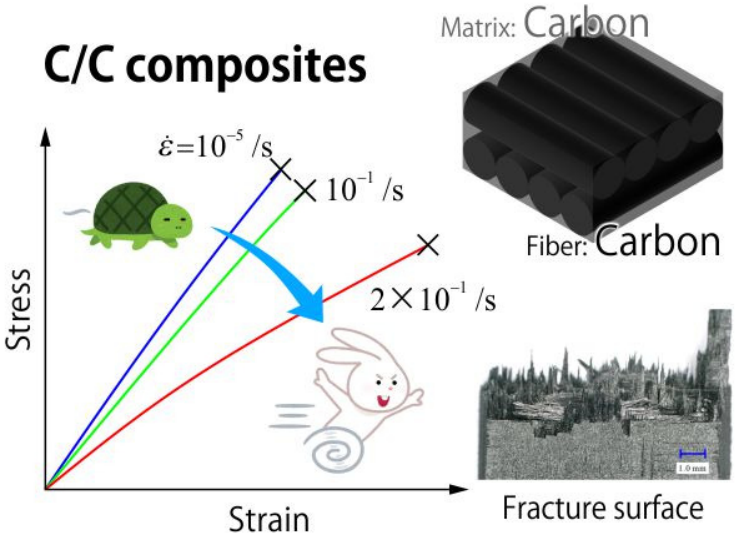
We use widely polymeric materials under various load profiles. Polymers show peculiar deformation behavior depending on load direction or condition. The uniaxial tensile test, which is a general method to determine mechanical properties of materials, cannot evaluate mechanical asymmetry and anisotropy of such polymers. In this study, we research strength of polymeric materials experimentally with mechanical asymmetry and anisotropy under multi-axial stress state or uniaxial tension-compression and evaluate the reliability and safety of polymers.

FE Analysis on DP Steels Based on Digital Image Processing



Dual-Phase steels (DP steels) which consist of Ferrite and Martensite, are attracting attention because of its high strength. It is known that the ratio of each phase significantly changes mechanical properties. However, an influence of the shape of each phase on mechanical properties is unclear. In this study, we grasp boundary information of each phase from a microstructure image of DP steels. We conduct FE analysis using the information obtained from the digital image processing and investigate the effect of the shape of each phase on mechanical properties.

Tensile Properties of Carbon-Carbon Composites



Carbon-Carbon (C/C) composites are advanced composites with excellent mechanical properties and are used as aircraft heat resistant materials in environments where dynamic loads are applied. Although it is imperative to understand the strain rate effect on tensile properties of C/C composites from its use, there are very few reports at present. In this study, the effects of strain rate on tensile properties are investigated by conducting tensile tests at different strain rates on C/C composites.