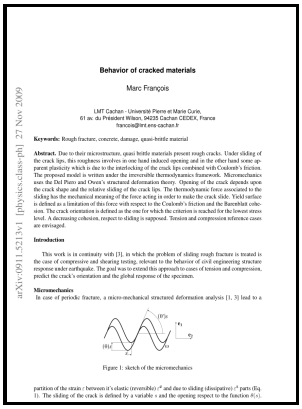
Micro-mechanics of damage in deformation and fracture

Dept. of Solid Mechanics, Technical University of Denmark - Plastic deformation in pediatric fractures: mechanism and treatment



Behavior of cracked materials

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Abstract. Due to their microstructure, quasi brittle materials present rough cracks. Under sliding of the crack lips, this roughness involves in one hand induced opening and in the other hand some apparent plasticity which is due to the interlocking of the crack lips combined with Coulomb's friction. The proposed model is written under the irreversible thermodynamics framework. Micromechanics uses the Del Piero and Owen's structured deformation theory. Opening of the crack depends upon the crack shape and the relative sliding of the crack lips. The thermodynamic force associated to the sliding has the mechanical meaning of the force acting in order to make the crack slide. Yield surface is defined as a limitation of this force with respect to the Coulomb's friction and the Barenblatt cohesion. The crack orientation is defined as the one for which the criterion is reached for the lowest stress level. A decreasing cohesion, respect to sliding is supposed. Tension and compression reference cases are envisaged.

Introduction

This work is in continuity with [3], in which the problem of sliding rough fracture is treated in the case of compressive and shearing testing, relevant to the behavior of civil engineering structure response under earthquake. The goal was to extend this approach to cases of tension and compression, predict the crack's orientation and the global response of the specimen.

Micromechanics

In case of periodic fracture, a micro-mechanical structured deformation analysis [1, 3] lead to a

Figure 1: sketch of the micromechanics

partition of the strain ε between it's elastic (reversible) ε^e and due to sliding (dissipative) ε^s parts (Eq 1). The sliding of the crack is defined by a variable s and the opening respect to the function $\theta(s)$.

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The first explanation of this discrepancy was given by Griffith in 1921. This is important in certain forming operations where appreciable deformation is required. One can imagine a single crystal as a deck of cards.

Deformation (engineering)

The bulges produced can separate from the original grain to form new grains by the formation of subgrain low-angle boundaries, which can evolve into grain boundaries, or by migration of the grain boundary. In drawing, for example, the load must be above the yield point to obtain appreciable deformation but below the tensile strength to avoid failure.

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Aktaa Projektinformation MatISSE EU, FP7, 604862 Schlagwörter ODS steel, Transmission electron microscopy TEM , Electron backscattered diffraction EBSD , Low cycle fatigue LCF , Ferritic-martensitic steel, Fatigue and fracture analysis, Deformation mechanisms, Damage mechanisms, Dislocation, High temperature materials, Dispersion strengtheneing, Microstructure characterization, Powder metallurgy.

ShieldSquare

The AIQ-ICF2008 has brought together researchers and engineers to review and discuss advances in the development of methods and approaches on Damage and Fracture Mechanics. It is therefore not necessary to create a dislocation, but simply to start an existing one moving on the slip plane. Such a process of structural deterioration of a material which results from the creation, growth and coalescence of microdefects is called damage.

DEFORMATION FRACTURE MECHANICS ENGINEERING MATERIALS

The opposite applies to the properties in a direction perpendicular to that working.

Deformation and fracture mechanisms of nanotwinned metals

Note that not all elastic materials undergo linear elastic deformation; some, such as , , and many polymers, respond in a nonlinear fashion. However, faults are introduced at the molecular level with each deformation. The linear relationship for a material is known as.

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