

FRACTURE MECHANICS OF MICROSAMPLES

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Key Words: Fracture mechanics, fracture toughness, fatigue, crack propagation

Fracture mechanics has been developed to avoid catastrophic failures of structures. It is nowadays the basic tool for damage tolerant design. From materials science point of view the development of materials with improved fracture resistance has become an important topic. The developed standards to determine the fracture mechanics parameters are adapted to sample sizes from centimetre to meter. The standards are designed to generate materials specific data and not size dependent parameters. The transferability of this testing procedure to dimensions of micrometers is important but not straight forward. The fracture mechanical properties of materials in small dimensions have become an important research area in materials science.

A driving force is the growing industrial importance of micro-electronic and micro-electromechanical systems and new down sized devices, for example for medical applications. The load bearing capacity and life time of such micro sized components are determined by the mechanical properties of the material with the corresponding dimensions. Another reason for the development of mechanical tests with samples in the micro range is the evaluation of individual properties of microstructural elements like grain boundaries or individual phases, which have typical dimensions in the micrometer and submicrometer regime.

The main goal of the paper will be devoted to:

- limits of the application of fracture mechanic tests to micro sized samples,
- when do fracture mechanic parameters remain size independent and when not,
- what can we learn from micromechanical tests about fracture of materials in general,
- can we solve fracture problems with microsamples which cannot be generated from conventional fracture mechanics tests.