



Introduction to the special issue on failure mechanism in advanced materials and structures

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In recent years, rapid advancements in materials engineering and advanced manufacturing technology have given rise to a myriad of innovative materials and structures. These developments aim to meet the increasing demands for characteristics such as high strength, lower density, high ductility, high conductivity, and other superior mechanical or physical properties. Notable examples include advanced alloys boasting a high strength-to-weight ratio, graphene, carbon nanotubes, ferroelectric ceramics, superconductors, metamaterials, quasicrystals, functionally

graded materials, soft-active materials, micro- and nano-devices, among others.

Over the years, many intriguing topics in fracture mechanics have witnessed significant progress, particularly regarding fracture behavior of advanced materials and structures. Advanced manufacturing and design technologies have introduced novel materials and structures catering to various applications, including lightweight materials and structures for automotive and aerospace applications, functional materials for nano- and micro-electromechanical systems (NEMS and MEMS), and piezoelectric materials for sensing, actuating and energy harvesting. A better understanding of the failure mechanisms of these materials and structures is essential to promoting their applications.

This special issue encompasses 13 papers selected from a larger pool of original submissions. All the papers underwent a rigorous peer-review process to maintain the standards of the International Journal of Fracture. Authors from various parts of the world covered a wide array of topics related to the failure mechanisms of advanced materials and structures, including:

- Fatigue crack nucleation in hydrogels
- Fatigue and fracture of high-strength aluminum and titanium alloys
- Transient heat conduction in a cracked medium

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- Punch contact problems involving elastic coating attached to a porous material
- Interface and planar crack problems of quasicrystals
- Size effect of quasi-brittle materials
- Damage strength and optimization of metamaterials
- Multiscale cracking of granodiorite
- Hydrogen embrittlement of pipelines
- Impact behavior of advanced ceramics
- Length scale sensitivity of finite element modelling of composites
- Contact problem of porous materials
- Damage strength and optimization of metamaterials

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