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Interface dissipation mechanism of nanocrystalline ceramics in thermal shock fracture

***L.H. Liang [1], X. N. Li[1], and Y. G. Wei[1]**

[1]Institute of Mechanics, Chinese Academy of Sciences, Beijing 100190, China.

*Corresponding author: lianglh@lnm.imech.ac.cn

Ceramics are widely used in many fields, such as biomedical, aerospace, and mechanical engineering, etc. In some service environment, the thermal shock frequently occurs, the conventional ceramics with micron-scale microstructure show the brittle fracture characteristics and the lower thermal shock resistance under the mechanical or thermal loading, which limits their application to a certain degree despite of ceramics' excellent thermal insulation, wear and corrosion resistance. Nanocrystalline ceramics attract more and more attraction due to their improved thermal shock resistance. In this talk, an interface dissipation model is presented, based on the thermodynamic expression of the interface energy, for nanocrystalline ceramics in thermal shock by considering the more grain boundaries and the competition of the interface energy with the elastic strain energy. Combining with the microscopic fracture characteristics of the thermal shocked ceramics, the mechanism behind the higher thermal shock resistance of nanocrystalline ceramics are discovered based on the model.

Keywords: Interface energy, Nanocrystals, Thermal shock, Ceramics