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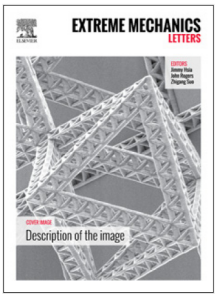

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Crack forbidden area in the anisotropic fracture toughness medium

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Abstract

In some rocks and crystals, the fracture toughness in one direction would be lower than the other directions, and the fracture behavior in the materials with anisotropic fracture toughness profile may be very different from the isotropic materials. The weak plane model is suitable to describe the fracture toughness property in such materials. Because of the attraction of weak plane direction, the fracture might never enter a sector of directions near the weak plane, instead, these kinds of fracture would deflect to the weak plane direction immediately. Such material-level crack forbidden area, which is protected by the weak plane, is demonstrated in this paper. The size of the forbidden area is found to be only related to one material constant, the fracture toughness ratio, and is independent of the angle between the fracture and the weak plane, or the ratio of stress intensity factors near the crack tip. An approximate expression of the crack forbidden area is also derived in this paper for the simplified model. The study on the crack forbidden area would be helpful to control the crack path in the anisotropic fracture toughness materials and protect parts of the medium by designing the material properties.

Keywords: Anisotropic material, Crack growth, Energy release rate, Fracture toughness, Crack path control

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