

## 功能梯度双材料弱/微间断界面的冲击断裂分析

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收稿日期 修回日期 网络版发布日期 接受日期

**摘要** 提出强间断、弱间断、微间断和全连续界面的概念与分类, 建立功能梯度弹性双材料弱间断界面冲击断裂问题的力学模型, 采用积分变换法推导问题的Cauchy奇异积分方程, 并用配点法求得数值解. 分析表明, 弱/微间断性对于FGMs界面裂纹应力强度因子有着重要影响, 而且微间断性是优于弱间断性的一种界面力学性能连接关系. 以FGMs界面某一侧的力学性能函数在界面处的Taylor展开式的低阶项作为界面另一侧的力学性能函数, 便可以使FGMs界面成为“微间断”界面. 界面的一阶微间断对应应力强度因子的减小作用较为明显, 而高阶(二阶及以上)微间断对应应力强度因子的影响较小. 减小界面的弱间断程度或使FGMs界面具备“微间断性”, 都将利于提高功能梯度双材料界面抗冲击断裂能力, 在一定程度上达到界面增韧的目的.

**关键词** [功能梯度材料](#), [弱间断界面](#), [微间断界面](#), [界面裂纹](#), [应力强度因子](#)

分类号 [0346](#)

## Impact fracture analysis of functionally gradient bi-material interface with weak/micro-discontinuity

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### Abstract

The concepts are clarified and a classification is suggested with respect to the strong-discontinuous, weak-discontinuous, micro-discontinuous and all-continuous interfaces. A mechanical model is established for impact fracture problems of functionally gradient elastic bi-material interfaces with weak discontinuity. Integral transform is used to derive Cauchy singular integral equation for the crack, and the allocation method is used to obtain numerical solutions. It is indicated that, the weak discontinuity and the micro-discontinuity have significant effects on stress intensity factors, and the micro-discontinuity is a kind of connection of interfacial mechanical property better than the weak discontinuity. By assuming the mechanical property of the FGM at one side of the interface to be the lower-rank terms of Taylor series with respect to that at the other side, the interface will become micro-discontinuous. The first rank micro-discontinuity is enough to reduce the stress intensity factors notably, however, the higher-rank terms, which are equal to or higher than the second rank, have less effect on stress intensity factors. To reduce the weak discontinuity or to make the interface micro-discontinuous are all beneficial to the enhancement of the capacity of the FGMs interface to resist impact fracture, i.e. to the enhancement of the interfacial toughness.

**Key words** [functionally gradient materials](#) [weak-discontinuous interface](#) [micro-discontinuous interface](#) [interfacial crack](#) [stress intensity factor](#)

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