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Contact damage resistant SiC/graphene nanofiller composites

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Abstract

The short-crack domain and contact damage resistances of silicon carbide (SiC) ceramics containing graphene fillers (graphene nanoplatelets -GNPs- or reduced graphene oxide sheets -rGOs) are investigated by performing Hertzian contact tests. A progressive deviation from the linear Hertzian elastic response with increasing graphene content takes place, the composite containing 20 vol.% GNPs being the most deformable material. When adding increasing amounts of GNPs, the damage beneath the contact zone turns from well-defined cone cracks of monolithic SiC to a widespread subsurface damage where microcracks are generated due to the matrix/graphene interface debonding by a shear faulting process. This mechanism enhances the contact damage resistance of the composites, redistributing the stresses at the contact and limiting the long-crack formation. The composite containing 5 vol.% rGOs fully precludes the cone cracks development and enlarges the quasi-plastic damage zone, extraordinarily enhancing the contact damage resistance that approaches to that of a ductile material.

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