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Impact Modelling of Cermet Composite

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Abstract

Cermet Materials (CM), for example, WC/Co, are used for cutting tools. It means that they are subjected for different kind of dynamic loadings. They have very good mechanical properties. However, the degradation of the CM material under dynamic load has not been enough thoroughly investigated.

Experiments, indicate that the fracture energy of WC/Co is expended through ductile failure of the Co close to the binder/tungsten carbide interface [1] or by dimple rupture across the interphase [2]. Stress concentrations around grain boundaries lead to initiation of microcracks which are dispersed by dynamic loading. However, there are no such predictions for impact conditions.

The main goals of the presentation are to investigate the previously formulated models of the two-phase composite [3, 4] under impacts and give qualitative predictions of the crack and plastic strains initiation for such cases. The phenomena are difficult to investigate experimentally. We take into account distribution of cermet phases, grain-binder interfaces and rotation of grains. We focus on the possibility of crack appearance in binder layers and in interface between the binder material and grain material.

We note that the behavior of the material is qualitatively different in case of impact from the quasi-static pressure load and pulse load. The particular difference is in the microcracks and plastic strains development in the case of impact. For example, in the case of impact plastic strains start to develop at the edges of the interfaces, while microcracking process begins in the middle of interfaces. The role of interface junctions is different in the investigated cases as well. We have found that in the case of impact, the model cannot be approximated by 2D modelling.

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