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A CRACK MODEL AROUND JUNCTIONS IN WC\CO COMPOSITE

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1. Introduction

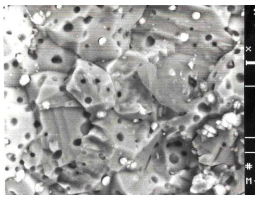
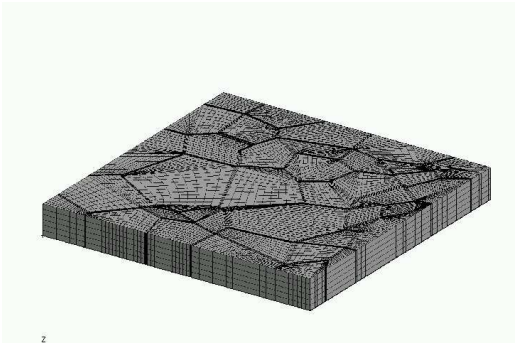
WC/Co ceramic metal-matrix composites are characterized by very high mechanical properties that allow for application the composites mostly in production of different types of cutting tools. By combining in a composite structure a phase of brittle a hard wolfram carbide (WC) grains with a metallic interface of cobalt (Co) that exhibits plastic properties, a geometrically complex microstructure with significantly different mechanical properties of the combined phases is created, see Fig. 1a.

The presence of elastic-plastic interface material, i.e. Co binder, in the composite structure is the reason for initiation of technological defects - mainly material porosity. During material loading pores start to coalescence and finally one can observe creation of microcrack system distributed along interfaces.

The aim of the presentation is to show the previously formulated model [1], [2] of the polycrystalline composite to be developed towards cracks development around the junctions of the interfaces.

2. Model

The polycrystal consists of elastic grains and metallic interfaces. The interface elements are introduced into the interfaces between the grains and into the the junctions as well. The model of the material in the grains is assumed elastic because of very high strength of the grains. The intergranular layers are viscous-elastic-plastic. The latter agrees with the experimental studies presented in [3], [4]. We apply the traction-separation law in the interfaces elements.


(a)

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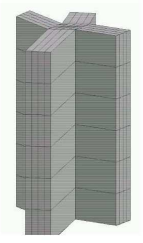
(c)

Fig. 1. SEM image of a WC-Co sample (a) FEA model of the sample (b) model of a junction.

The SEM photograph is given in Fig. 1 (a). The FEA discretization reflects the system of the grains and the The FEA discretization that takes into account the separate discretization of the grains and the interfaces is shown in Fig. 1 (b). Additionally, we show the detail of a junction between the intergranullar layers, Fig. 1 (c). The sample is subjected to uniaxial tension.

3. Concluding remarks

With the presented scheme we are able to calculate stresses and strains in the sample. We can observe the cracks development the interfaces. The cracks are intesive in the junctions. They are intensive in the neighbourhood of the imperfections in the form of voids in the junctions as well.

4. References

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