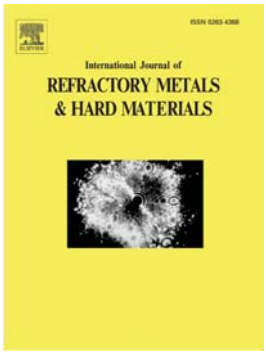

SPH and FE coupled 3D simulation of monocrystal SiC scratching by single diamond grit

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SPH and FE Coupled 3D Simulation of Monocrystal SiC Scratching by Single Diamond Grit

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Abstract. An investigation was carried out to study the material removal modes in single diamond grinding of monocrystal SiC. In order to reveal the influences of diamond shapes on the removal regions of SiC, six diamonds of different shapes were used for scratching. Three shapes - cube, rectangular pyramid, and cubic octahedral were chosen to simulate ideal diamond shapes, whereas cone, ball, and triangular pyramid were used to express wear diamond shapes. Through combining two different simulation methods - FEM and SPH, the material removal process was simulated respectively for the grinding of SiC with single diamond grit of different shapes. A grinding test was also carried out for the diamond of cone shape in order to check the validity of simulation. It was shown that the simulation results agree basically well with the corresponding experimental results. Therefore, the influences of the different diamond shapes on the removal modes of SiC were analyzed and discussed mainly based on the simulation. The scratching length and the ratio of width to depth of the groove generated in scratching were used as the parameters to discuss the influence of diamond shapes. The forces in grinding with different diamond grits were also analyzed.

Keywords: diamond shape; removal modes; FEM&SPH; monocrystal SiC; scratching

1. Introduction

As a kind of advanced material, monocrystal silicon carbide (SiC) has large band gaps, high critical breakdown field strength, high electron mobility and good thermal conductivity. Therefore, it is considered as an ideal material to manufacture the optoelectronic integrated device with high temperature, high frequency, high power and radio resistance [1]. However, its high hardness, high brittleness and low fracture toughness make it prone to generate deformation layer, surface/subsurface micro-cracks, fuzzy surface, phase transformation zone and residual stresses. As

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