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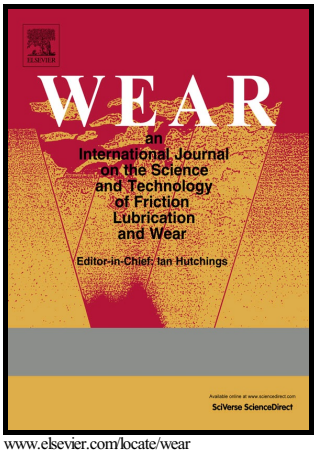

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The wear mechanisms of reaction bonded silicon carbide under abrasive polishing and slurry jet impact conditions

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Abstract. A study of the wear mechanism on a reaction bonded silicon carbide (RB-SiC) subjected to fixed abrasive polishing and loose abrasive waterjet (AWJ) impact conditions is presented. It is found that the wear of the material is characterised by different mechanisms in its silicon and silicon carbide constituents. The surface polished by diamond abrasives appears with brittle fractures on the silicon carbide phase, while the silicon phase is found to be plastically deformed and embedded onto the surface of the fractured silicon carbide. Sub-micrometre surface finish can be obtained by polishing using silicon carbide abrasives, and the process is initiated through the penetration of abrasive tips into the softer silicon matrix. Since the progressive wear flattens the tips of abrasives, the penetration depth of abrasives into the material gradually decreases. When the penetration depth is below a critical value, ductile material removal mode becomes dominant in the removal process. When abrasives that are softer than the silicon carbide grains are sufficiently introduced onto the material surface by a slurry jet, wear can occur even at a pressure below the critical value for phase transformation of the silicon constituent. Wear takes place mainly through weakening the Si bond by erosion and wedging, which eventually releases the SiC grain from the material structure. It is feasible to use a relatively low-pressure alumina slurry jet to machine RB-SiC without causing any surface damage and the processed surface quality depends mainly on the material structure.

Keywords: Abrasive Wear; Reaction Bonded Silicon Carbide; Phase Transformation; Particle Hardness; Slurry Jet

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