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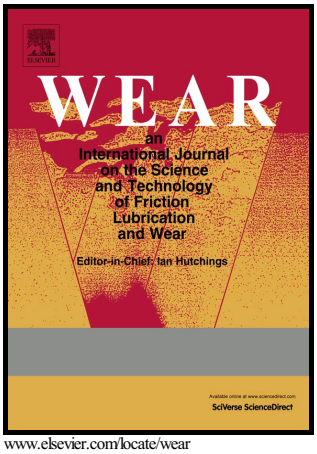

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Surface damage mechanism of monocrystalline silicon during single point diamond grinding

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Abstract

Surface damage mechanism of single crystalline Si (100) under single point diamond grinding was investigated in the present study. The result, for the first time, showed that the ductile and brittle material removal appeared at different grinding positions of the diamond wheel due to the varied kinematics of the diamond grits in the cylindrical face and end face. Under the dynamic pressure of the diamond grits, amorphization and the transformation to high pressure phases (Si-III and Si-XI) of Si occurred, which were identified by both XRD and Raman spectroscopy. In addition, surface oxidation and chemical reaction between the Si, O, C and N atoms was analyzed by the XPS, and the new products of Si_3N_4 and graphite oxide (GO) are firstly proposed to be the surface damage of Si and the tool wear mechanism during the ultra-precision machining process.