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Quasi-static and Dynamic Response of 3D-printed Alumina

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Abstract

Mechanical properties and microstructure of 3D-printed alumina processed using pressurized spray deposition have been compared to a commercial sintered alumina. The 3D-printed alumina microstructure was found to be bimodal in nature, with alumina particles agglomerated into large spheres, which resulted in 6.1% porosity. Compared to the sintered alumina, the 3D-printed material exhibited lower quasi-static and dynamic compressive strength, negligible differences in quasi-static and dynamic Vickers hardness, and negligible differences in quasi-static and dynamic fracture toughness. However, while the dynamic fracture surfaces of 3D-printed alumina were smooth and planar, large undulations were observed under quasi-static loading. It is concluded that the pressurized spray deposition 3D-printing technique is a promising method for processing alumina with properties comparable to that produced by traditional techniques, and further improvements may be gained by eliminating porosity.

1.0 Introduction

The complexity of a component shape can sometimes limit the choice of materials for its fabrication. This limitation either eliminates use of certain materials due to difficulty in machining