A Freeform Extrusion Process for Producing Solid Ceramic Components

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ABSTRACT
An extrusion-based additive manufacturing process, called Ceramic On Demand Extrusion (CODE) process, is introduced in this paper for producing three-dimensional ceramic components with near theoretical density. In this process, aqueous paste of ceramic particles with a very low amount of binder content (<1 vol%) is extruded through a moving nozzle at room temperature. After a layer is deposited, it is surrounded by oil (the oil reaches right below the top surface of the part) to preclude non-uniform evaporation from the sides. Infrared radiation is then used to partially and uniformly dry the last layer so that the yield stress of the paste increases and the part can maintain its shape. The same procedure is repeated for every layer until the part is fabricated. Several sample parts for various applications are produced using this process and the properties of printed alumina components are obtained using standard test techniques. The results indicate that the proposed method enables fabrication of large dense ceramic parts with complex geometries.

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