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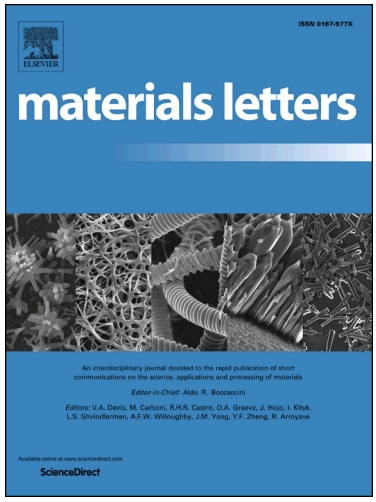

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Ceramic Binder Jetting Additive Manufacturing: Particle Encapsulation for Increasing Powder Sinterability and Part Strength

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ABSTRACT

The objective of this research is to test a hypothesis that particle encapsulation increases the sinterability of ceramic powder. This method is developed for binder jetting additive manufacturing but tested using a pressing and sintering route for the simplicity. Binder jetting additive manufacturing has demonstrated its considerable capability in manufacturing ceramic parts with a complex shape and/or a customized design. Currently, the density of the ceramic parts made by binder jetting is low and their mechanical properties are not satisfactory. The main reason is the low sinterability of the powder feedstock. A new particle modification method called particle encapsulation was applied to increase the powder sinterability and the part strength. Specifically, coarse crystalline alumina particles (70 and 10 μm in average) were encapsulated with amorphous alumina, in which the microsized core was designed to provide the high flowability and the amorphous shell to promote sintering due to its high activity. The encapsulated powder was pressed into disk samples and sintered. The samples from the encapsulated powder showed significantly higher shrinkage and compression strength than those from the raw powder, which proved the feasibility of the particle encapsulation method to increase the powder sinterability and part strength.

Keywords: Additive Manufacturing; 3D Printing; Ceramics; Powder Technology; Sol-gel; Sinterability