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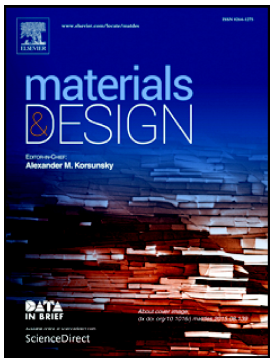

Environment-friendly and reusable ink for 3D printing of metallic structures

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Title: Environment-friendly and reusable ink for 3D printing of metallic structures

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Abstract

There is an increasing need for 3D printing of metallic structures in a green and cost-effective way. Here, an environment-friendly and reusable metallic ink was developed for an economical metal 3D printing method. The metallic ink is composed of steel micro powders, a biodegradable polymer: chitosan, acetic acid and deionized water. The metal 3D printing method consists of: (i) 3D printing of metallic structures using the metallic ink at room temperature, (ii) thermal treatments on the as-printed structures that decompose the polymer binder and sinter the steel powders, and (iii) an optional step: infiltrating melted copper into the sintered structures to achieve fully dense metal/metal hybrid structures. We demonstrate that any incorrectly built as-printed structures and scrap materials can be recycled and reused for 3D printing by dissolving them again in acetic acid. The fabricated structures after copper infiltration feature a low filament porosity of 1.0% which enables high properties such as an electrical conductivity of 1.3×10^6 S/m and a Young's modulus of 160 GPa. The metallic ink can be used for the 3D printing of high performance metallic structures while demonstrating a low environmental impact and a very effective utilization of metallic materials.

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