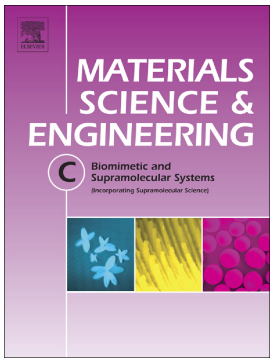

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Open porous dealloying-based biomaterials as a novel biomaterial platform

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Abstract

The close match of stiffness between implant material and bone is critically important to avoid stress-shielding effect and ensure a fast healing of injured tissues. Here, we introduce liquid metal dealloying method for synthesis of robust open porous biomaterials possessing low Young's modulus. The remarkable advantage of the liquid metal dealloying method is a large flexibility in selecting chemical composition of a desired porous biomaterial together with unique tunable microstructure. To demonstrate the versatility of the method, a number of open porous Ti_xZr_{100-x} alloys with different chemical compositions and microstructural characteristics was developed by dealloying precursor $(Ti_xZr_{100-x})_yCu_{100-y}$ alloys in liquid magnesium. The effects of the processing conditions and the precursors' chemical composition on the microstructure of the porous Ti_xZr_{100-x} as well as their mechanical behavior were discussed in detail. In particular, the porous Ti_xZr_{100-x} distinguish themselves due to a low and tunable stiffness ranging from 3.2 to 15.1 GPa and a rather high strength reaching up to 480 MPa. This unique combination of mechanical properties of the new open porous Ti_xZr_{100-x} alloys becomes even more interesting in view of preliminary biological tests highlighting their excellent cytocompatibility. Overall, the liquid metal dealloying provides an opportunity for designing a new biomaterials platform with flexible tunable functionality.