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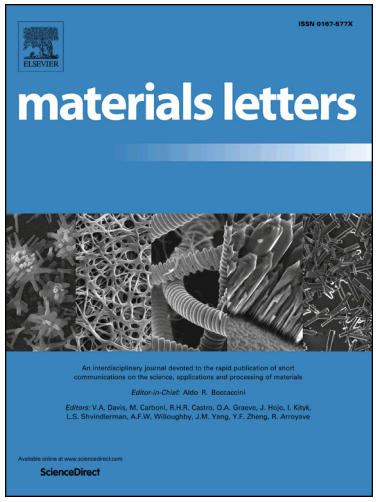

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Development of Fe_3O_4–HA/PU superparamagnetic composite porous scaffolds for bone repair application

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Abstract

Magnetic stimulation and magnetically responsive scaffolds can play unique roles in promoting bone repair and regeneration. Here, we designed and fabricated a novel type of magnetic porous scaffold that integrates superparamagnetic, cytocompatibility, and osteostimulation properties by incorporating a spherical core–shell nano-iron oxide–hydroxyapatite (Fe_3O_4–HA) composite into polyurethane (PU). Its structural, physicochemical and magnetic properties, as well as its preliminary cytocompatibility were evaluated. The results show that the scaffold had a highly interconnected porous structure with a porosity of about 65%，a pore size distribution of 100–600 μm and a compressive strength of 4.16 MPa. The results of the magnetic hysteresis loops suggest that the composite scaffolds possess superparamagnetism and that the saturation magnetization of the scaffold was about 2.19 emu/g. The cell culture indicates that the porous magnetic scaffold had good cell affinity and cytocompatibility. In general, this study demonstrates that the Fe_3O_4–HA/PU composite scaffold integrating both magnetic properties and biocompatibility may be an ideal candidate material for bone repair.

Keywords: Biomaterials; Fe_3O_4-HA/PU; magnetic materials; cytocompatibility; porous scaffolds

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