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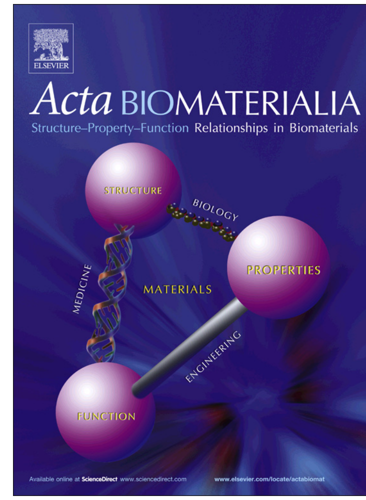

Full length article

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Toughening of fibrous scaffolds by mobile mineral deposits

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Abstract

Partially mineralized fibrous tissue situated between tendon and bone is believed to be tougher than either tendon or bone, possibly serving as a compliant, energy absorptive, protective barrier between the two. This tissue does not reform following surgical repair (e.g., rotator cuff tendon-to-bone re-attachment) and might be a factor in the poor outcomes following such surgeries. Towards our long-term goal of tissue engineered solutions to functional tendon-to-bone re-attachment, we tested the hypotheses that partially mineralized fibrous matrices can derive toughness from mobility of mineral along their fibers, and that in such cases toughness is maximized at levels of mineralization sufficiently low to allow substantial mobility. Nanofibrous electrospun poly(lactic-co-glycolic acid) (PLGA) scaffolds mineralized for prescribed times were fabricated as model systems to test these hypotheses. Tensile tests performed at varying angles relative to the dominant fiber direction confirmed that mineral cross-linked PLGA nanofibers without adhering to them. Peel tests revealed that fracture toughness increased with mineralization time up to a peak value, then subsequently decreased with increasing mineralization time back to the baseline toughness of unmineralized

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