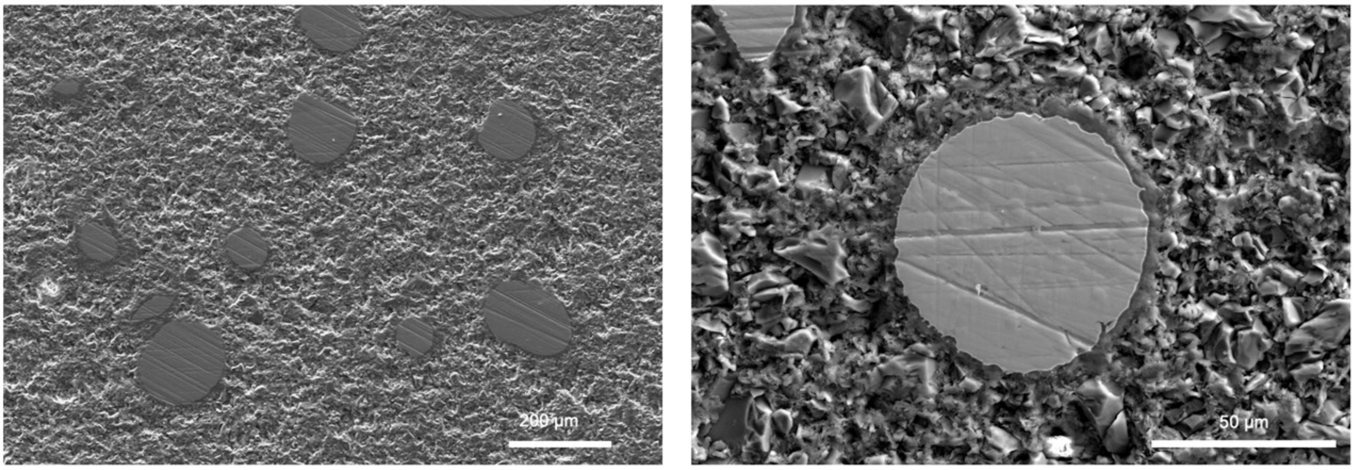
ETH zürich

Licensing Opportunity

Fibre-reinforced absorbable bone cement for load-bearing orthopedic applications



Scanning electron microscopy images of cross sections of the fibre-reinforced bone cement. A phosphate coating leads to an exceptionally good integration of fibres into the cement-matrix resulting in high strength and ductility of the composite.

Application

This absorbable bone graft fills large voids within bone tissue after trauma or oncology therapy, augments bone structure and fixes non-degradable implants. The material supports mechanical stresses well and lends itself to load-bearing applications.

Features & Benefits

- enhanced strength and significantly improved ductility
- biocompatible and absorbable
- drillable and malleable

Publications

- A. Rich et al., Magnesium-fiber reinforced bone cement with enhanced mechanical properties, Biometals Conference 2022
- Patent pending: WO 2024/037952

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Reference 2022-053

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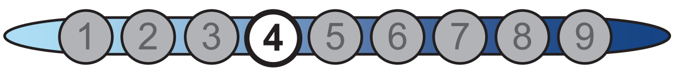
Technology Readiness Level



Background

Currently available ceramic-based bone cements have excellent biocompatibility. Their tensile, shear and bending strength are, however, rather low and as a major issue, they are exceptionally brittle, which diminishes their applicability in load-bearing applications.

Invention

Commercial bone cement (e.g. calcium phosphate cement) is reinforced with ultrastrong (800 MPa) magnesium alloy fibres. The fibres have an amorphous microstructure. They can be randomly oriented, partly oriented, or uniaxially oriented along the expected stress trajectories. A phosphate coating leads to an excellent fibre-cement-interface. Under shear stress no cracks propagate along the fibres. The resulting composite is stronger and tougher than comparable solutions. A production method for the fibres is introduced, which offers precise control over the fibre length.

The fibre-reinforced bone cement is drillable, malleable and likely injectable (method to be developed). Its setting time is set by the cement phase.

The components of the fibres (magnesium, zinc and calcium) are essential nutrients in the human body. They slowly degrade in contact with water or body fluids and are resorbed by the human body.

Currently in vivo trials in rabbits are ongoing, characterizing the bone-regrowth in the voids formed by the degrading cement.