

PhD Project (e.g. P1)	Host institution	Start date (e.g. Month 6)	Duration (e.g. 48 months)	Supervisors (primary and co-supervisor)
P1	TU Wien	1	48	A. Ovsianikov/M. Raith/ I. Giouroudi
Project Title: High-strength, fibre reinforced biocomposites				
Hypotheses/Aims: The goal of this project is the development of a novel class of biodegradable fibre reinforced composite materials, which should serve as a future alternative to titanium-based implants. These new materials are based on a thermosetting polymer matrix, reinforced with bioglass fibres. By the use of photopolymerization, these composites can be polymerized on-site, facilitating an adaption of the required patient-specific geometry.				
Short Description of the PhD project and Role of both Organizations (TUW & FH Campus): The project team aims at reaching high strength values of the resulting composite (target: >350MPa bending strength). At the same time, the elastic modulus will be kept as closely as possible to that of cortical bone. By in-vitro tests, these composites will be screened regarding their suitability as high-strength, personalised implant devices. The biocompatibility of these materials will be evaluated in vitro at the FHCW by analysing their cytotoxicity, cell adhesion, proliferation and their effect on the immune system. The key components of the composite are the organic matrix material and the inorganic reinforcement. The matrix polymer will be based on photopolymerizable resins, since these materials offer several benefits: The mechanical as well as biofunctional (e.g., degradation speed) properties of these materials can be tuned very easily. Bioglass fibres will be used as reinforcement material, due to their beneficial properties for hard-tissue replacements. Overall goal of the project is to provide a completely new class of biocomposite materials, which will pave the way for innovative approaches in traumatology and maxillo-facial surgery. TU Wien is responsible for screening appropriate photopolymerizable formulations based on methacrylate- and/or vinylester-chemistry. Additionally, fibre reinforced composites based on 1-06 bioglass will be prepared. Reactivity, double-bond conversion and leaching of residual monomers will be assessed. The mechanical response of the finally obtained composite will be tested (bending strength, dynamic mechanical analysis, fractography). Initial experiments which have been performed using commercially available bioglass fibres yielded composites with strength values beyond 250MPa.				
Expected Results: <ul style="list-style-type: none"> • Availability of photopolymerizable, high-strength biocomposites with bending strength >350MPa. • Statements on biocompatibility will be obtained 				
Participating Faculty: A. Ovsianikov , I. Giouroudi (TUW), M. Raith (FHCW)				
Planned lab rotations: TU Wien: 42 months (manufacturing of composites, mechanical characterization, screening of monomers and fibres) FHCW: 6 months (3 months in year 2, 3 months in year 4): biological assays, investigation of residual monomers				