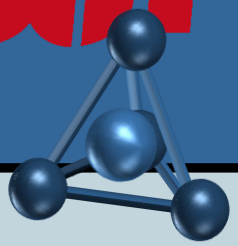
# Forschungsprojekt

**Fachgebiet Werkstofftechnik**



## Additive manufacturing: Hierarchically structured ceramic materials

Many natural materials have exceptional mechanical properties, which are difficult to reproduce in materials engineering. One example are teeth which are astoundingly resistant under the harsh fatigue and environmental loading conditions in the mouth. They possess potent strengthening and toughening mechanisms to hinder crack formation and propagation.

Zirconia materials have found increasing interest for tooth replacements, because of their toughness, biocompatibility and aesthetic appearance. In contrast to teeth, they are prone to brittle fracture despite the inbuilt transformation toughening mechanism of certain zirconia formulations. We investigated possibilities to further increase the toughness of zirconia-based ceramic constructs by implementing hierarchical features into the structure, that were shown to be important for the fracture resistance of teeth. Electrophoretic deposition (EPD), which is an additive manufacturing process, has been shown a very promising method to produce multi-layered zirconia samples.

We are working on a new method for the investigation of fatigue in hierarchically structured ceramics on the nanoscale by using a nanoindenter. The nanoindenter is a useful tool for the local analysis of the influence of layers, gradients and material inhomogeneities on the fatigue behaviour. We further investigate the mechanical properties of multi-layered samples by bending tests and the influences of the number and thickness of the layers and their sequence.

**Dipl.-Ing. Cecilia Müller**

cecilia.mueller@tu-berlin.de

**Forschungsthemen**

Additiv gefertigte Strukturen
Hierarchische-Strukturen
Bioinspirierte Materialien

**Materialien**

Zirkoniumdioxid