# NANOSCIENCE COLLOQUIUM

## Additive manufacturing of bio-inspired & living composites

**Kunal Masania k.masania@tudelft.nl**

**Shaping Matter Lab, Faculty of Aerospace Engineering, TU Delft, NL**

**Abstract**: Composite materials in nature exhibit heterogeneous architectures that are tuned to fulfill the functional demands of the surrounding environment. Examples range from the cellulose-based organic structure of plants to highly mineralized collagen-based skeletal parts like bone and teeth. Because they are often utilized to combine opposing properties such as strength and low-density, the heterogeneous architecture of natural materials can potentially address several of the technical limitations of artificial homogeneous composites. However, current man-made manufacturing technologies do not allow for the level of composition and fiber orientation control found in natural heterogeneous systems. In this talk, I will show that additive manufacturing (AM) routes might offer a new exciting pathway for the fabrication of biologically-inspired materials with unprecedented architectures. The talk will explain our recent work on two distinct materials: liquid crystal polymers and mycelium laden hydrogels. Proof-of-principle examples will be presented to illustrate the potential of AM technologies for the fabrication of composites with widely-tunable properties and functionality.

**Bio:** Dr. Kunal Masania is an Associate Professor at the Faculty of Aerospace Engineering.
After studying Mechanical Engineering at the University of Loughborough, Kunal carried out his PhD at Imperial College London on size effects and nanoscale toughening of thermosetting polymers. At the University of Applied Sciences of Northwestern (FHNW) Switzerland he developed a variety of advanced processing approaches for high-performance composites, such as rheo-kinetic control, compression RTM, highly reactive polymers, discontinuous composites and natural-fibre thermoplastic composites. Then Kunal joined the Complex Materials Group at ETH Zürich, to develop new bio-inspired materials, 3D printing of biological materials and nacre-like composites.
His group at TU Delft now re-imagine how composites are made today, with an emphasis on structuring hierarchical materials in three dimensions using design inspiration from the natural world. With the clear goal of producing structural details with complexities that are only possible with additive manufacturing, his group that works on topics from material synthesis, additive manufacturing of bio-inspired and living composite materials and their structures - to mechanics and mechanical behavior. Having co-founded two startups, he very much likes to push breakthrough science to applications that can impact society.

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

**18.04.2023 1:15 pm | Bd.600**
**R.301 CHyN**

CHyN
Center for Hybrid Nanostructures