

Additive Manufacturing of Ceramics: From technical ceramics to artificial corals



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Abstract: Additive manufacturing (AM), also known as 3D printing, is a group of technologies that enables the manufacture of complex designs and customised parts with remarkable geometric freedom that would be unfeasible to produce by other processes. While the AM of metals and polymers is more known and has a larger market share, the AM of technical ceramic materials is an emerging topic with relevant possible applications, including dental and bone prostheses, artificial corals, fuel cells, high-temperature materials for turbines and heat exchangers, semiconductors, catalysis supports, porous media for CO₂ capture and absorption, machining inserts, and other applications for extreme environments. The first part of this talk will present an overview of the principles of the main additive technologies for ceramic materials, including vat-photopolymerization (VPP), material extrusion (MEX), and binder jetting (BJT), comparing their principles, advantages, and challenges, with examples developed by the Laboratory of Tribology and Composites. The second part of the talk will present the ongoing study in collaboration with the University of Edinburgh and Heriot-Watt University to 3D-print artificial corals made with the same material as natural ones to study the effects of ocean acidification on coral porosity. This talk is supported by the São Paulo Research Foundation (FAPESP) [grant #2025/00377-4].

Biography: Dr Mateus Mota Morais is an Assistant Professor (Tenure-Track) at Mechanical Engineering Department at the São Carlos School of Engineering, University of São Paulo (EESC/USP), Brazil. His research interests include additive manufacturing (particularly vat-photopolymerization) and ceramic forming processes, as well as machine design, finite element analysis, and the manufacture of artificial rocks. He holds a PhD (2024) in mechanical design, materials, and manufacturing from EESC/USP, Brazil, in cotutelle with the University of Padua (UNIPD), Italy, with a thesis on manufacturing porous carbonate rocks and other calcium carbonate structures through 3D-printing. He holds a Bachelor's degree (2017) and a Master's degree (2020) in Mechanical Engineering from EESC/USP. He graduated with distinction, receiving the CREA-SP Award for professional training and an honourable mention in the ABCM Award for Research in Mechanical Engineering for his undergraduate and PhD theses. He worked as an intern at MTE-Thomson from 2016 to 2017, where he developed the mechanical design of machines to produce ceramic sensors for vehicles