

# MATERIALS SCIENCE AND TECHNOLOGY

## AMMIN - Biobased polymeric materials for 3D printing by liquid deposition modelling

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<b>Context of the research activity</b>	The research field is the additive manufacturing of circular and sustainable polymeric products. Innovative biobased polymers and reversibly crosslinked composites with natural fillers as cellulosic fibers will be developed and exploited in Liquid Deposition Modelling as a 3D printing technology.
<b>Objectives</b>	<p>The main aim of the doctoral research activity is to develop polymer-based composite materials for the production of three-dimensional objects by additive manufacturing, fulfilling the principles of circularity and sustainability throughout their entire lifecycle.</p> <p>Biobased prepolymers (e.g. epoxidised natural oils) and natural fillers (e.g., cellulose, eventually in the form of fibers) will be chemically modified and used for the preparation of solvent-free pastes, which will be processed by Liquid Deposition Modelling, LDM, a 3D printing technique currently mostly applied for ceramics. The pastes will be hardened either with thermal or photoinduced crosslinking reactions, during or after 3D printing, ensuring adequate mechanical properties. Crosslinking will be based on reversible chemistries to obtain vitrimers, allowing a more efficient and functional recycling of the printed object at the end-of-life, with recovery of the prepolymer and fillers.</p> <p>The research work will thus include:</p> <ul style="list-style-type: none"> <li>- functionalisation of prepolymers and fillers;</li> <li>- study of reversible crosslinking processes;</li> <li>- thermal and mechanical characterisation of the composites;</li> <li>- optimization of biobased materials formulations for 3D printing;</li> <li>- 3D printing by Liquid Deposition Modelling (LDM);</li> <li>- characterisation of the printed object;</li> <li>- recycling/reprintability testing;</li> <li>- LCA of the investigated materials and processes.</li> </ul>
<b>Skills and competencies for the development of the activity</b>	The PhD candidate should preferably have an education (M.Sc.) in Materials Science or Engineering,, Polymer Chemistry or related fields. In particular a background in polymer processing, characterization, additive manufacturing, knowledge on CAD software are evaluated, as well as attitude for lab activities. and team working. Problem-solving skills, and high motivation to

the activity

learn through advanced research are requested.