3D PRINTING OF POLYMERS: CURRENT TRENDS AND ADVANCED APPLICATIONS

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Additive manufacturing (AM), commonly known as 3D printing, represents a transformative technology with significant potential to advance materials science through novel applications across various disciplines. AM enables the development of innovative materials, including resins, inks, powders, and filaments, for various techniques such as digital light processing, stereolithography, two-photon polymerization/multiphoton polymerization, fused deposition modeling, direct ink writing, selective laser sintering/selective laser melting, electrohydrodynamic printing, inkjet printing, among others. These materials encompass polymers, biopolymers, ceramics, metals, and (nano)composites. They are pivotal for advanced applications in energy conversion, environmental remediation, sensors, 4D printing (stimuli-responsive materials), superhydrophobic/oleophobic surfaces, fog harvesting, lightweight structures, tissue engineering, and cell proliferation, among others. Furthermore, integrating artificial intelligence (AI) and machine learning with big data analytics enhances the design and optimization of these materials, accelerating their development and providing deeper insights into the micro- and nanoscopic structure-property relationships of 3D-printed materials. In this invited Talk, I will cover some current trends and advanced applications of 3D printing focussed on polymer materials.

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