3D printing of Carbon Architectures using bio-based resins

DIRECTEUR DE THESE : CAMELIA GHIMBEU & ARNAUD SPANGENBERG
INSTITUT DE SCIENCE DES MATERIAUX DE MULHOUSE, 15 RUE JEAN STARCKY, 68057 MULHOUSE
TEL : 03 89 60 88 42 ; E-MAIL : CAMELIA.GHIMBEU@UHA.FR & ARNAUD.SPANGENBERG@UHA.FR

Unlike conventional subtractive methods, 3D printing allows rapid prototyping and customization on demand. However, as a process recently applied to carbon-based materials, 3D printing faces many challenges, including the precise tailoring of the printed material and the control of its porosity. Besides, the sustainable nature of the carbon precursors is extremely limited. The current project proposes the development of multifunctional materials (carbon and Carbon/metal NPs hybrids), using sustainable precursors and involving additive manufacturing in the fabrication process. Low cost, sustainable, renewable precursors (biopolymers and natural phenols), and green solvents (water…) will be used to produce the carbon materials [1]. They will have high chemical and thermal stability which will be advantageous for application in energy storage (supercapacitors, batteries) and environmental remediation (water cleaning) [2]. A particular attention will be paid to tune the pore size to match that of the electrolyte and pollutant molecule, which may allow to enhance the performance. The structure will be also optimised by using different synthesis conditions. The extension of such structures in forms of thin films or specific architectures by 2D and 3D additive manufacturing represent a real challenge and will be adressed herein. 3D photostructuration approaches implemented at IS2M [3-4] and the fine modulation of several experimental parameters will deliver films and microstructures on centimetre scale. In addition, printing approaches will generate hierarchical 3D objects to be explored in various applications. The materials obtained by these unconventional techniques might benefit from specific properties (porosities at different scales, improved conductivity pathways and better adherence) to boost energy storage and adsorption performance.

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