3D printing components for energy storage devices

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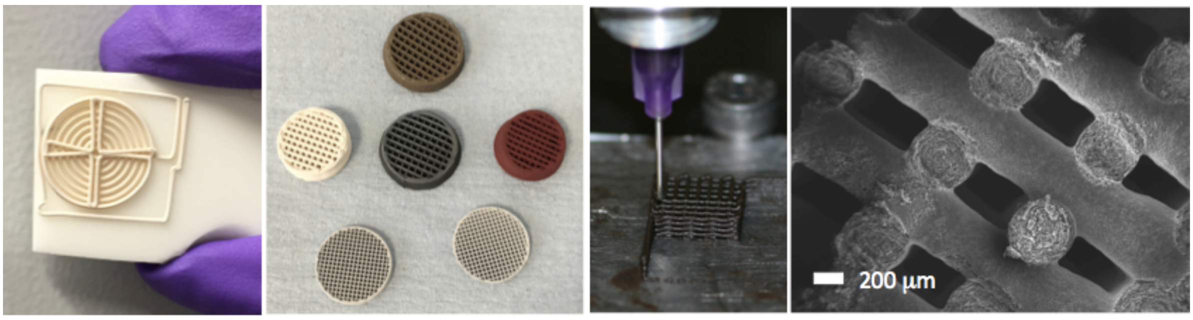
As new technologies in key areas such as energy and medicine develop, the demand for state-of-the art fabrication to create complex multifunctional devices also grows. An emerging group of techniques known as Additive Manufacturing (AM) are based on making a 3D solid object of virtually any shape from a digital model. An 'addition process', where objects are usually built layer-by-layer following a computer design. The freedom of creating completely new designs is what makes AM technologies - for some considered the next industrial revolution - so attractive. However, the challenge of making this prediction a reality demands a major effort in material development, since the commercial applications in AM are now mostly limited to a number of metals and polymers.

On the other hand graphene - with its two dimensional structure and unique combination of properties - is the 'wonder' material with promising applications. But to actually exploit all the advantages of this fascinating material, it is necessary to develop manufacturing routes to create graphene 3D components and integrate them into practical devices while preserving its multi-functionalities at the macro scale.



We have developed ink formulations for AM using responsive building blocks approaches [1-3]. These formulations are water based, flexible and easily scalable up. They allow us to design 3D-inks for different materials, from ceramics and metals to chemically modified graphene, enabling the printing of multi material devices. I will present the processing approach, the rheological behavior of our inks to satisfy the demands for direct ink writing, the printing and characterization of different structures as well as introducing a proof of concept of graphene based devices for supercapacitors.

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