Carbon Nano Onions for biomedical and catalytic applications

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Abstract: Multi-shell fullerenes, known as carbon nano-onions (CNOs), are structured by concentric shells of carbon atoms and are emerging as platforms for biomedical applications because of their ability to be internalized by cells and low toxicity. [1] In my research group we have developed a synthetic multi-functionalisation strategy for the introduction of different functionalities (receptor targeting unit and imaging unit) onto the surface of the CNOs. The modified CNOs display high brightness and photostability in aqueous solutions and are selectively taken up by different cancer cell lines without significant cytotoxicity. [2]
To probe the possible applications of CNOs as a platform for therapeutic and diagnostic interventions on CNS diseases, we injected fluorescent CNOs *in vivo* in mice hippocampus. We analyzed *ex vivo* their diffusion within brain tissues and their cellular localization by confocal and electron microscopy. The subsequent fluorescent staining of hippocampal cells populations indicates they efficiently internalize the nanoparticles. Furthermore, the inflammatory potential of the CNOs injection was found comparable to sterile vehicle infusion, and it did not result in manifest neurophysiological and behavioral alterations of hippocampal-mediated functions [3]. These results encourage further development as brain disease-targeted diagnostics or therapeutics nanocarriers.

In addition, carbon nano-onions (CNOs) have recently shown promising ORR performance after mono-[4,5] and dual-atom doping process [6]. We synthesised boron/nitrogen-codoped carbon nano-onions (BN-CNOs) by a low cost thermal annealing process and we have investigated ORR activity in alkaline media. Our results showed remarkable catalytic performances via a four-electron pathway and higher long-term stability compared to the standard Pt/C catalysts [6]. Our findings confirm that CNO electrocatalysts are promising candidates to replace the expensive Pt catalysts in fuel cells.

References:

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