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Development of Electrically Conductive Polylactic Acid Matrix Composite Containing Carbon Nanotubes ***A12***

Interest in electrically conductive polymers has grown in recent decades. Sectors such as sensor manufacturing, biomedical applications and the electronics industry see their potential. One way to make a polymer conductive is to mix conductive particles into it. These can form electrically conductive paths, called percolations, thereby increasing the electrical conductivity. Examples of such conductive fillers are carbon fibres and carbon nanotubes. When used together, there is a good chance that the nanotubes will interconnect the carbon fibres to form a conducting network. In the field of polymer matrix materials, there is a growing interest in polymers from renewable resources, whose applications in engineering are under-researched. Of these, polylactic acid (PLA) has come to the fore, with its favourable mechanical properties providing a good basis for engineering applications. In our research, we aim to develop conductive composites with a polylactic acid matrix containing nanotubes and carbon fibres. The composite compounds were prepared by twin-screw extrusion; the compounds were then processed by injection moulding. It was shown that the electrical conductivity increased only slightly when only carbon nanotubes were added to the PLA matrix. However, when carbon fibres were added to the system, the higher shear during melt mixing promoted uniform dispersion of the carbon nanotubes, resulting in a high conductivity reinforcement network in the composite. On the other hand, the hybrid reinforcement resulted in higher viscosity, which made the melt processing more difficult and the material also became more brittle.

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Vis-NIR Ag2S Quantum Dots for Bio-Applications ***A13***

Over the last ten years, silver sulphide quantum dots (Ag2S QDs) have emerged as a promising non-toxic alternative to traditional binary heavy metal containing QDs for bio-medical applications due to their ultra-low solubility product constant (Ksp = 6.3 x 10-50)1 in aqueous media, almost non-existent toxicity2, strong photoluminescence, and tuneable Vis-NIR emission3. Typically, most research focuses on the bottom-up, organic synthesis of Ag2S QDs due to the resulting favourable optical properties including, ease of size control, tuneable emission in the NIR-II region and high quantum yield4. However, recently due to the toxic chemicals and harsh conditions exploited in organic synthesis, there has been a focus on shifting towards greener, aqueous synthetic methods allowing for the synthesis of instantly biocompatible QDs at lower temperatures without the need for phase transfer and the associated diminution of their fluorescence intensity5. Utilising a simple aqueous-based hot injection approach, ultra-small (< 2 nm), red-emitting L-glutathione (GSH) capped Ag2S QDs have been synthesised. Through manipulation of both the initial pH of the solution, Ag:Ligand feed ratio and reaction time, size control at the sub 2 nm scale and quantum confinement visualised through the respective absorbance properties have been observed. PL studies revealed the QDs exhibited strong 700-nm emission, independent of size, suggesting the presence of trap-state emission at ultra-small sizes, providing an exciting opportunity for the development of new ultra-small, non-toxic bio-probes with the possibility of renal excretion and reduced risk of accumulation in the body.

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Spontaneous Formation of Carbon Dots Reveals Molecular Fluorophores Species ***A14***

Carbon dots (CDs) display photophysical features that appear similar, if not identical, apart from the numerous synthetic protocols to obtain them. However, the photoluminescence (PL) mechanism associated with the carbon core, surface, and molecular fluorophores states remains controversial. Recently, the group of M. Prato emphasized that the properties of solvothermal-synthesized CDs could be affected by the presence of unreacted species or small organic molecules [1]. The group of M. Otyepka pointed out that the intense excitation-independent PL component of CDs is attributed to molecular