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Supramolecular gelation of low molecular weight gelators and UV-curable monomers

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Low molecular weight gelators (LMWG) are compounds with a molecular weight of less than 2000 Da, which show gelation behaviour in solvents (in-or-organic). Their diverse application spans from personal care products, polymer nucleation/clarification, dental composites, energy technology and liquid crystalline materials and many more. Their use as new materials for 3D printing can have significant potential application in forming complex hierarchical structures for interesting application in various sectors. For example, star polymers can be incorporated into the gel formulation or *vice versa* to provide support for new composites for 3D printing. Ultra violet (UV) curable monomers are extensive range of mono-functional, di-functional and tri and higher functional acrylate monomers are used to reduce viscosity of uncured UV energy curing material and facilitate application. UV curing is a photopolymerization technique resulting in a three-dimensional polymer network from monomers and oligomers after exposure to UV light. UV induced cure has many advantages over conventional cure in terms of less energy consumption and equipment space, reduced waste, less emission, higher productivity (fast cure) and lower temperature treatment. In addition, UV curable resins usually do not contain any organic solvents that have an adverse effect on the environment. However, shrinkage and resolution are issues that need to be resolved. A library of small molecular weight gelators with hugely varying chemical functionality has been synthesized and their suitability for formulation of a large range of carrier media has been characterized. In addition, a comprehensive investigation of carrier composition and rheology effect on certain lead gelator structures has been assessed. To determine their printability parameters, gelators that act as viscosity modifiers are formulated as additives for 3D printing so that they can make single or multiple colloidal networks. The novel composites (gelator and polymers) are under investigation for preliminary jetting in order to select ideal candidates for 3D printing applications. Preliminary data have shown LMWGs show different morphology depending on the monomers. To date, 3D printing (extrusion) has been trialled with the best combination of monomer/gelator.

Biography

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