

Self-assembly of naphthalene diimide (NDI) within polysilsesquioxane gel

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Gel is a solid-like material composed of a huge amount of solvent entrapped into a 3D network, known as a supramolecular gel when the 3D network is formed by physical interactions between the molecular units or polymer gel when the solvent is immobilized by covalent cross-linked structures^[1,2]. In both cases, the organization of building elements within the network is a key element that determines the mechanical and electrical properties of the gel.^[2] There is thus a great interest in being able to control or tune the organization of those building elements in order to improve the applicability of polymer gels in areas such as tissue engineering, optoelectronics, catalysis, drug deliveries and so forth^[1,2].

Our own work focuses on hybrid gel materials obtained by polycondensation of silsesquioxane $R-[SiO_{1.5}]_n$ ($n \geq 1$). Depending on the nature of the organic group R, physical interactions and steric effects between organic units act as driving forces in the structural organization of the network. Simultaneously, the formation of intermediate silanols can also influence the orientation of the precursors through the formation of intermolecular hydrogen bonds^[3,4]. After gelation, the aging period begins, in which phenomena such as densification of Si-O-Si structures, solvent evaporation, reorganization of the 3D network occurs^[3]. The objective of our work was to characterize the reorganizations processes occurring within naphthalene diimides (NDI)-containing polysilsesquioxane gels during aging process. Spectroscopic measurements carried out on these materials suggest the emergence of new modes of aggregation between NDI centers. Furthermore, the observation of drastic color changes from yellow to red during the aging period is attributed to the existence of redox reactions, to the formation of extended π -systems (polymorphs) and/or CT complexes.

References:

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