Investigation on a nanostructured self-healing hydrogel during in situ gelling and thermo-responsive processes by coherent SAXS

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Abstract

Polymer hydrogels with multifunctionality are highly desirable for biomedical applications. The structure evolution of the hydrogels is a crucial factor in determining their final properties and functionalities. In the present study, a novel hydrogel with self-healing, fast-gelling, and thermo-responsive properties was synthesized. The hydrogel showed a hierarchical structure, containing both network-like fractal structure and core-shell micellar structure. The unique structure was investigated by time- and temperature-resolved coherent small-angle X-ray scattering (SAXS) techniques at Taiwan Photon Source 25A1 (TPS 25A1). The resulting scattering curves were fitted by model analysis software (SAS View) to extract the multi-scale information, such as the fractal dimension of the network, the size of the micellar structure, and the local chain distance. The structure-function relationship of the hydrogel was correlated to achieve a better understanding on designs of the hydrogel as stem cell carriers or bioadhesive tissue fillers.