

## Supporting Information

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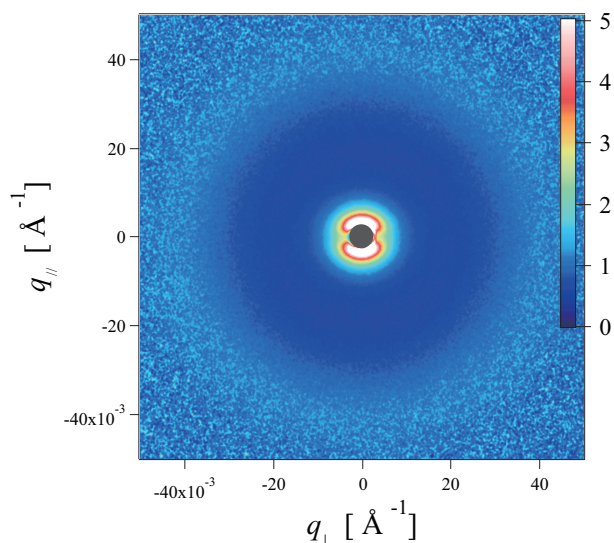


FIG. S1: 2D structure factor of PAM-NP gel at  $\lambda = 1.36$ . In this experiment, we loaded silica nanoparticles which have different size and surface from what we used in the main text.

To check the reproducibility of the two spot pattern as

shown in Fig. 2, we introduced silica nanoparticles (Ludox AS-40 (Dupont)), which are different from what we used in the main text (Ludox TM-50), into the PAM gel. From the preliminary SAXS experiment, the mean radius of nanoparticles was estimated to be  $\sim 90 \text{\AA}$ . The composition of the hydrogels is the same as Table 1. SAXS measurements were carried out at the BL8S3 beamline at Aichi Synchrotron Radiation Center that is located in Seto, Aichi, Japan. A monochromated X-ray beam with a wavelength ( $\lambda$ ) of  $1.5 \text{\AA}$  was used to irradiate the samples at room temperature, and the sample-to-detector distance was set to be 4 m. The scattered X-rays were counted by an imaging plate detector.

2D structure factor of PAM-NP gel with AS-40 at  $\lambda = 1.36$  is shown in Fig. S1. Fig. S1 is a magnified figure in the vicinity of beam center. Gray circle corresponds to a beam stop. We successfully observed the similar 2-spot patterns in the similar  $q$  range as Fig. 2. This result indicates that two spot patterns are highly reproducible, can be observed regardless of the type of nanoparticles, and reflect network structure of PAM gel itself.