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Supporting Information for

Rheological properties of a ultra-high salt hydrophobic associated polymer as fracturing fluid system

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Experimental Section

Characterization. The purified UUCPAM with potassium bromide(KBr) tablet was prepared to characterize its molecular structure. The infrared spectroscopy (NICOLET 6700, USA) had a wave number range between 4000 cm^{-1} and 400 cm^{-1}, and a resolution of 0.01 cm^{-1}. The nuclear magnetic resonance hydrogen spectrum (^1H NMR) of copolymers in D_2O were measured using Bruker AVANCE III HD 400 (Bruker, Switzerland). The concentration of the polymer solution was 100 mg/L.

X-ray Diffractometry (XRD). The UUCPAM was measured by X-ray diffraction measurements using an X-ray diffractometer with *Cu*, k_α radiation target at 40 mA and 40 kV and a scan rate of 1 deg/min, step size of 0.05 degree, with the scattering angle (2θ) ranging from 10^o to 90^o.

Analysis of Fluorescent Pyrene. Pyrene (purchased from Alfa Aesar Corporation) is a fluorescence probe. Pyrene is recrystallized twice with absolute ethanol and removed impurities drying in vacuo at 50 ℃. At room temperature, a certain amount of pyrene is weighed which is dissolved in ethanol. Ethanol pyrene-dissolved solution and primary mother liquor are obtained with a 100ml volumetric flask. By adding extract certain amount of pyrene solution from primary mother liquor to 50mL volumetric flask with pipette tube, ethanol pyrene-dissolved

solution and secondary mother liquor are obtained. Preparation of UUCPAM solution to be tested: first dissolve UUCPAM to be tested with high-purity water, prepare UUCPAM solutions in various concentrations; Accurately 0.5mL secondary mother liquor was extracted into 20m1 ampoule, which was dried to a small drop with cold air. Finally UUCPAM solution was added in ampoule with pyrene, seal and conduct 1 hour ultrasonic vibration, standing for 24 hours after shaking evenly to be measured.

Viscoelasticity. The viscoelasticity as a function of strain and frequency sweep for 0.1 wt%, 0.3 wt% UUCPAM solution and 0.1 wt% UUCPAM + 0.5 wt% SDS, 0.3 wt% UUCPAM + 0.5 wt% SDS were measured using an Anton PPar rheometer with CP50-1-SN30644 plate fixture (diameter=0.099 mm). To ensure the consistency of the experimental conditions, all samples were measured at 25 ^{o}C.