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Supplementary Material

**Copolymer nanocomposites with strong adsorption of exfoliated silicate
nanosheets and high-temperature stability**

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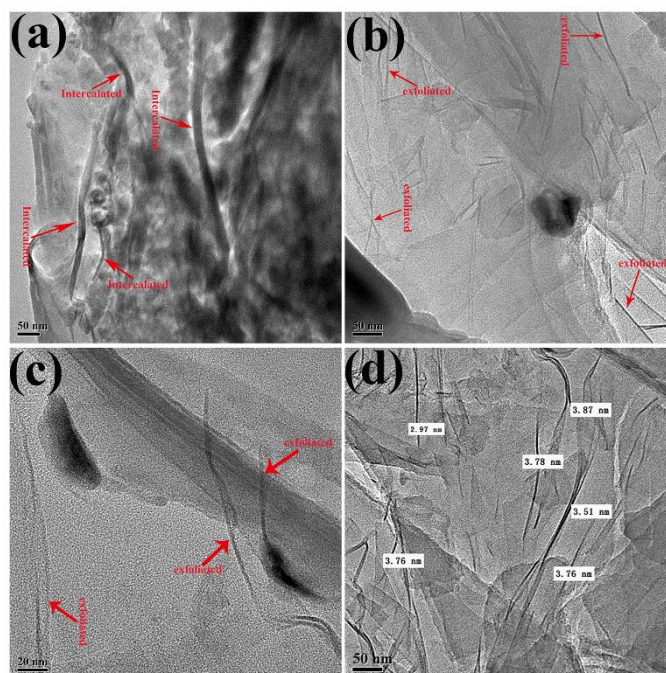


Fig. S1 TEM images of (a) unmodified Mt (scale: 50 nm), (b) AAS/1.0 wt% I-Mt (scale: 50 nm), and (c) AAS/1.0 wt% I-Mt (scale: 20 nm); (d) thickness of the nanosheets in AAS/1.0 wt% I-Mt.

Larger interlayer distances and thinner nanolayers are known to provide stronger nanoeffects. As shown by the TEM image of unmodified Mt in Fig. S1a, Mt is only intercalated with H₂O. Therefore, the interlayer distance expands negligibly, and unmodified Mt does not show strong nanoeffects. Consequently, the comprehensive performance of unmodified Mt is very poor. Notably, upon the modification of Mt with sodium 1-dodecanesulfonate to form I-Mt, the interlayer distance increases significantly. Moreover, after polymerization, the nanosheets in I-Mt were completely exfoliated. In TEM images with 50 and 20 nm scales (Fig. S1b and c), about 52 and 16 exfoliated silicate nanosheets, respectively, can be observed. Moreover, all the exfoliated silicate nanosheets are well distributed in the polymer nanocomposite. The

thicknesses of the exfoliated silicate nanosheets were measured (Fig. S1d), and the average thickness was determined to be 3.62 nm. Therefore, the AAS/I-Mt polymer nanocomposites are expected to show excellent nanoeffects. Indeed, AAS/I-Mt exhibited improved high-temperature resistance, salt resistance, and shear resistance, which allowed this polymer nanocomposite to be applied as an additive to improve the high-temperature resistance of water-based drilling fluids.

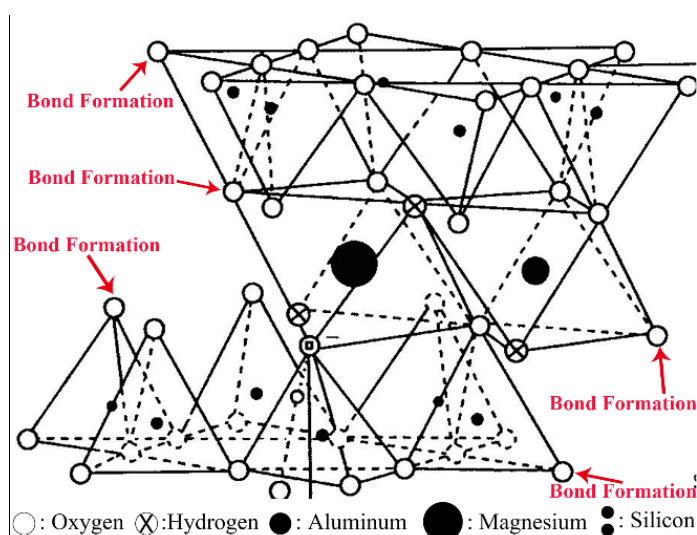


Fig. S2 Bonding sites in exfoliated Mt nanosheets.

Fig. S2 shows the crystal structure of exfoliated Mt nanosheets. The crystal structure unit of Mt consists of two silica tetrahedral sheets and a central alumina octahedral sheet. Negative charges are generated on the surface of the Mt layers owing to the isomorphic substitution of lower valance ions (Na^+ , Mg^{2+} , and Fe^{2+}) for the central atoms (Al^{3+} and Si^{4+}) in the interior layers. The exfoliated silicate nanosheets in I-Mt have more exposed surface oxygen groups than the intercalated layers in unmodified Mt. These oxygen groups on the surface of exfoliated silicate nanosheets act as bonding sites for the polymer (AAS). Therefore, the exfoliated silicate nanosheets can be

strongly adsorbed on the polymer chains. This phenomenon contributes to the high-temperature resistance, salt resistance, and shear resistance of the AAS/I-Mt polymer nanocomposite and thus to its promising performance as an additive in water-based drilling fluids.