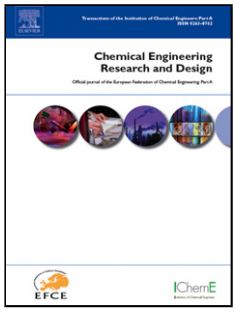

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Experimental and theoretical investigation of methane hydrate induction time in the presence of triangular silver nanoparticles

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Abstract

Low formation rate of hydrates has restricted their industrial applications; however, new promoters could be introduced as appropriate solutions. In this study, the nucleation of the methane hydrate was theoretically and experimentally investigated in the presence of triangular silver nanoparticles in an aqueous solution (4.5, 9, 18, 27 and 36 μM) at initial pressures of 4.5, 4.8, 5, 5.3 and 5.5 MPa and temperatures of 275.15 and 276.15 K. The results revealed that these nanoparticles reduced the induction time up to 97% in comparison with pure water. All of the obtained data were put into the Kashchiev-Firoozabadi model; however, the calculated error was not acceptable. As a result, a new model for calculating induction time in the presence of nanoparticles was carried out. The average absolute deviation between measured and predicted induction time was 13.82%. The methane hydrate/solution effective interfacial tension in the presence of nanoparticles according to heterogeneous nucleation was estimated. The model represented that increase in nanoparticles concentration contributes to declining of effective interfacial tension of methane hydrate/solution.

Keywords: Methane hydrate; Silver nanoparticles; Induction time; Interfacial tension.

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