

New and Recoverable Kinetic Hydrate Inhibitors Using Metal Organic Frameworks (MOFs)

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Injection of kinetic hydrate inhibitors (KHIs) is one of the most promising hydrate prevention methods for flow assurance caused by gas hydrate formation. In this study, we designed new KHIs made of metal-organic frameworks (MOFs), which have great possibility of effectively inhibiting methane hydrate formation and can be easily recovered and reused because of their physical properties. To measure the kinetic inhibition performance of MOF-based KHIs, we used a high-pressure autoclave with a temperature ramping method. We changed functional groups and particle sizes to find an optimum condition for the MOF-based KHIs. Besides, the Fe_3O_4 nanoparticles were encapsulated in the MOF ($\text{Fe}_3\text{O}_4@MOF$) for recovery of the MOF after use using magnetism. The $\text{Fe}_3\text{O}_4@MOF$ exhibited a comparable performance to the pure MOF and most of them was recovered using a bar magnet (99.3%). The performance of the MOF-based KHI was similar to that of a conventional inhibitor. This is the first example of using a MOF as a gas hydrate inhibitor and will be useful for future application in real fields.