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Inorganic nanoparticles facilitate pour point depressing ability of polymeric pour point depressants

Fei Yang
China University of Petroleum, China

Polymeric pour point depressants (PPDs) have been widely used in many waxy crude oil pipelines. However, traditional PPDs still have some defects such as unsatisfactory pour point depressing ability for crudes, poor thermal and shearing resistibility. Enlightened by the advantages of polymer/inorganic nanocomposites, we developed nano-hybrid PPDs by dispersing nanoparticles into polymeric PPD matrixes to prepare nanocomposite PPDs in order to enhance the performance of traditional PPDs. Firstly, spherical nano-silica was chosen to prepare polyacrylates/hydrophilic silica nano-hybrid particles and it was found that the hybrid particles could modify the morphology of the wax crystals precipitated from model waxy oils, thus further decreasing the gelation point, viscosity, yield stress of the waxy oils. However, the efficiency of the hybrid particles decreases greatly with rest time to pure efficiency of PPDs in the end. It is deduced that the compatibility between the oleophilic PPDs and the hydrophilic nano-silica is not good. In order to strengthen the compatibility between PPDs and nano-particles, the plate-like nano-clay was organically modified by quaternary ammonium surfactant and then dispersed into polymeric PPDs. Compared to an identical content of PPD's, addition of polymer/clay nanocomposite PPDs to waxy crude oil improves the rheological properties while elevating the wax appearance temperature of the oil. Polarized microscope observation shows that polymer/clay nanocomposites provide wax nucleation sites upon which wax molecules assemble and precipitate. Addition of polymer/clay nanocomposite PPD results in larger and more compact crystal morphology, thus inhibiting the formation of a network structure, and further improving rheological properties of waxy crude oil.

Biography

Fei Yang has completed his PhD from Shandong University. He is at present the associated professor of China University of Petroleum. His main research interests focus on the rheology of crude oils, flow improvers of crude oils, crude oil emulsions and wax deposition of crude oil pipelines. He has published more than 20 papers in reputed journals and has been serving as reviewer of many reputed journals.

yf9712220@sina.com

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