

Synthesis of iron oxide nanoparticle by water-in-oil microemulsion method and its application as catalyst for heavy or extra-heavy oil upgrading

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Recent years, heavy or extra-heavy oil has received attention because conventional oil is gradually depleted. However, because of its high viscosity and density, lots of energy and cost are used to transport to upgrading facilities through pipeline. To reduce energy consumption for transportation, in situ partial upgrading process for lowering viscosity is required. For using a catalyst of RTP which is one of the upgrading processes, iron oxide nanoparticles were synthesized by using W/O microemulsion with water/ethanol/sodium oleate/toluene. Synthesized nanoparticles had relatively uniform size (~5nm) and shape. Also, they have superparamagnetism, which can be used for recovery of them after cracking reaction. By XRD, it was verified that these nanoparticles are mostly composed of magnetite ( $\text{Fe}_3\text{O}_4$ ) and maghemite ( $\gamma\text{-Fe}_2\text{O}_3$ ), and their TEM image showed that they have spherical shapes and about 5nm diameters. The synthesized iron oxide nanoparticles were added to RTP reactor as catalyst. In comparison to liquid products without catalyst, liquid yield were similar. In case of quality, percentages of saturates and aromatics were increased, and resins and asphaltenes were decreased.