Crowned Iron

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The aim of project was to synthesize iron and iron oxide nanoparticles(NP), stabilize them by crown ethers and study catalytical properties.Diazacrown ether was used as stabilizer due to its supramolecular properties, so it was able to bind to surface of metal NP via non-valence bonding such a dipole-dipole, ion-dipole, hydrogen bonding, etc. It was predicted that synthesized NPs serve as effective catalyst in oil recovery process. We used chemical methods for preparation of iron and iron oxide NPs. For synthesis of Fe0 NP we reduced of iron salts by sodium borhydride. Fe_3O_4 NPs was synthesized by wet coprecipitation of Fe(II) and Fe(III) salts. The stabilization of prepared NP was achieved by application of diazacrown compound. Study of morphology of NPs was carried out SEM, AFM, IR spectroscopy methods. Catalytical properties of NPs we study in model reaction in oil-water system. The gases evolved during reaction were analyzed by gas-liquid chromatography. The size of NPs determined by SEM and AFM analysis vary between 10-40 nm for Fe0@crown and 7-17nm for Fe_3O_4@crown. Addition of NPs as catalyst in oil-water system led to evolving of H_2 and CH_4 gases evolving even without heating. This is strong evidence of super catalytical activity of NPs. During research, we synthesized Fe0@crown and Fe_3O_4@crownNPs and studied their catalytic properties in model reaction in water-oil system. The water-oil system was chosen deliberately in order to find out what happens if we use nanocatalysts in oil field. After the experiment we came to conclusion that application of these NPs led to evolving of gases and this fact can contribute to increasing of pressure in oil layers. We believe application of synthesized NPs can considerably increase oil recovery from long exploited oil fields