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Effect of Magnetic Nanoparticle Additive on Characteristics of Magnetorheological Fluid

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Magnetorheological (MR) fluids have been considered as one of the smart materials because of their controllable characteristics with external magnetic field. Since their first discovery, there have been a lot of studies on MR characteristics and their applications. However, the MR fluids, comprised of magnetic particles with high density dispersed in carrier fluids with comparatively low density, possess dispersion stability problems against gravitational settling.

MR fluids, suspension of magnetic carbonyl iron (CI) and magnetic additive in non magnetic carrier, were prepared in this study. The magnetic nanoparticle additive was synthesized in a rather simple process. First, oleyl amine and kerosene were mixed in a 3-neck flask and heated about 150^{o}C. At 150^{o}C, penta carbonyl ($Fe(CO)_5$) was added into flask under severe stirring. After 60 min, the mixture was cooled to room temperature. The magnetic particles were then precipitated by adding ethanol into flask. The supernatant was removed by centrifugation. For dispersion stability, the mixture was redispersed in hexane with oleyl amine [1]. The mixture was then dried by vacuum drying and the magnetic property of particle was confirmed via VSM. MR fluids, prepared as a mixture of CI and magnetic additive of different weight ratio in carrier fluid, were investigated under different external magnetic field strengths via a rotational rheometer [2]. MR properties with magnetic additive were observed to be analogous with MR fluid without any additives, but its dispersion stability was improved by adding magnetic nanoparticle additive [3].

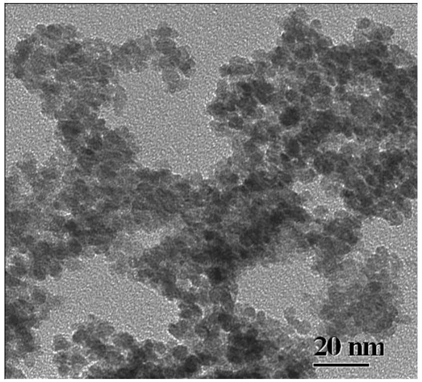

Fig. 1. TEM image of magnetic particle synthesized by penta carbonyl.

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Simple Synthesis Route and Magnetism of Carbon Nanotubes Via Hot-filament-assisted Cracking of $Ni(C_8H_{12})_2$

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Multi-wall carbon nanotubes were simply fabricated by hot-filament-assisted thermal decomposition of bis(1,5-cyclooctadiene)nickel [$Ni(C_8H_8)_2$]. $Ni(C_8H_8)_2$ powdery precursors were loaded in the reaction chamber and then the reaction chamber was evacuated. Solenoid-typed nichrome wire was heated up to 500^{o}C in order to thermally decompose precursor vapors. The decomposition reaction was completed in a 5 min or so. Carbon nanotubes including Ni metal nanoparticles were mainly observed on the surface of nichrome wire. After collection of the products, they were characterized by using X-ray diffraction (XRD) spectrometer, field-emission scaaning electron microscope (HRTEM), and magnetic property measurement system (MPMS; SQUID). The magnetic hysteresis loops show mixed properties of ferromagnetism and diamagnetism, contributed by nickel nanoparticle and carbon nanotubes, respectively.