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Electrorheology for Efficient Energy Production and Conservation R. TAO, ENPENG DU, HONG TAO, XIAOJUN XU, Temple University, YUN LIU, NIST Center for Neutron Research — At present, most of our energy comes from liquid fuels. The viscosity plays a very important role in liquid fuel production and conservation. For example, reducing the viscosity of crude oil is the key for oil extraction and its transportation from off-shore via deep water pipelines. Currently, the dominant method to reduce viscosity is to raise oil's temperature, which does not only require much energy, but also impacts the environment. Recently, based on the basic physics of viscosity, we proposed a new theory and developed a new technology, utilizing electrorheology to reduce the viscosity of liquid fuels. The method is energy-efficient, and the results are significant. When this technology is applied to crude oil, the suspended nanoscale paraffin particle, asphalt particles, and other particles are aggregated into micrometer-size streamline aggregates, leading to significant viscosity reduction. When the temperature is below 0°C and the water content inside the oil becomes ice, the viscosity reduction can be as high as 75%. Our recent neutron scattering experiment has verified the physical mechanism of viscosity reduction. In comparison with heating, to reach the same level of viscosity reduction, this technology requires less than 1% of the energy needed for heating. Moreover, this technology only takes several seconds to complete the viscosity reduction, while heating takes at least several minutes to complete.

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