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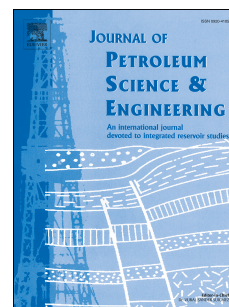
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# Use of Nanoparticles for Oil Production Applications

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## Abstract

When synthesized in a specific size range and with a special surface coating tailored to achieve certain desired functionalities, nanoparticles exhibit unique properties with tremendous application potentials. Accordingly, explosive advances have been made in development of functional nanoparticles and their novel use in a wide variety of medical, biological, engineering and other applications. The upstream oil industry is now vigorously catching up to adapt those technologies to develop its own unique applications. The first unique application is that specially surface-coated nanoparticles used as stabilizers, CO<sub>2</sub> foams, and emulsions with cheap, low molecular weight hydrocarbons can be improved mobility under harsh reservoir conditions and formulated as an “intelligent” additives for drilling, cementing and other downhole applications. The second application can be as a detection instrument of fluid and rock properties of producing reservoir zone because nanoparticles can flow easily long-distance deep in the reservoir. Nanoparticles have extraordinary mechanical strength, electrical and thermal conductivity, which can be applied to enhance performance, reliability and durability of structural materials used by the upstream oil industry. In this comprehensive review on the use of nanoparticles for oil production applications, the current status of the nanoparticle applications development in the areas of (i) drilling and completions; (ii) production operation and flow assurance; (iii) reservoir sensing; (iv) enhanced oil recovery; and (v) heavy oil recovery is provided in details. The basics of nanoparticle physics and chemistry is also first introduced.

Keywords: nanotechnology, superparamagnetic nanoparticles, silica nanoparticles, oil production, oilfield application, upstream oil industry

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