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Effect of nanoparticles on the modifications of drilling fluids properties: A review of recent advances

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1 **Effect of Nanoparticles on the Modifications of Drilling Fluids**

2 **Properties: A Review of Recent Advances**

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7 **Abstract**

8 Production from unconventional hydrocarbon resources, such as shale gas, shale oil,
9 deepwater and arctic reservoirs requires advanced drilling and extraction technologies.
10 Furthermore, minimizing the environmental footprints associated with oil recovery processes
11 are critical. Nanotechnology has been shown promising solutions to overcome such issues in
12 oil and gas industry. Many studies have been conducted to analyse the enhancement of
13 drilling fluids through the use of nanotechnology. In these studies modification of
14 rheological, filtration, and heat transfer properties and friction reduction associated with
15 drilling fluids have been investigated. They also showed that nanoparticles can improve fluid
16 thermal stability, provide better lubricity, hole cleaning and wellbore stability, and mitigate
17 hydrates formation within the fluid circulation system. This manuscript aims to analyse the
18 outcomes of these studies and improvements that were observed for the application of
19 nanoparticles in drilling fluids. This review provides the investigators with a detailed
20 overview and comparison of the recent advancements in the field of drilling fluids and
21 nanotechnology.

23 **Keywords**

24 Drilling Fluids, Nanoparticles, Rheological Properties, Filtration, Friction Reduction

26 **Introduction**

27 Use of nanotechnology in oil and gas industry has been improved rapidly over last decades.
28 Adding nanoparticles (NPs), because of their very ultrafine size (<100 nm) and high surface
29 area to volume ratio, allow engineers to modify the drilling fluids rheology by changing the
30 composition, type, or size distribution of nanoparticles that suit desired drilling conditions
31 without using other expensive additives (Abdo and Haneef 2012). In recent years, numerous
32 studies have been reported on the application of nanoparticles as additives in drilling fluids
33 formulation (Abdo and Haneef 2012, Amanullah et al. 2011, Sharma et al. 2012, Srivatsa and

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