

Application of Nanomaterials in Drilling and Completion Operations



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Abstract

This paper reviews the recent challenges faced in oil and gas operations specifically the drilling and completion sector. The application of nanomaterials in drilling and completion operations in mitigating these challenges were analyzed as well as the factors retarding the growth of the application of this emerging technology.

Introduction

Nanomaterials are now a growing trend in this current age of technology. Its applications have cut across different kinds of sectors of the modern age industries. According to the US Foresight Institute, Nanomaterials can be defined as a group of emerging technologies in which the structure of matter is controlled at the nano scale to produce novel materials and devices that have useful and unique properties. This also brings about the creation of new materials with enhanced properties such as mechanically, optically, magnetically and many others. The oil and gas have also capitalized on this new technology to help to improve upon the operations in oilfields.

Drilling and completion challenges are encountered in a lot of oilfields. Some of these problems are

The ineffectiveness of the conventional tools to withstand adverse environmental conditions, shale instability, fluid loss, bit balling, fines migration, exposure to harmful gases like hydrogen sulfide and many others [1]. These numerous challenges tend to place restrictions and income loss constraints on the drilling and completion operation.

Nanomaterials are basically materials which are constructed at the atomic or molecular scale with a dimension of a nanometer, and hence it can be assembled to give a preferred feature or product [2]. These materials possess some distinct structural features like large fraction grain boundaries, triple junction and high surface area per unit mass or volume. The distinctive structure features of the nanomaterials give it enhanced properties compared to their bulk materials

[3,4]. The nanomaterials have emerged to be a suitable and efficient solution to major challenges faced in the drilling and completion operations due to its robust features. It has been applied in drilling and completion operation to mitigate various challenges. The areas of application for nanomaterials in drilling and completion are expressed below.

- a) High-Performance Drilling Fluids
- b) Shale Inhibitors
- c) Coatings
- d) Lubricants
- e) Drilling Bits
- f) Plugging Materials for Reservoir Protection
- g) Cement

Eventhough the nanomaterials has proven to be the most efficient solution to various drilling and completion challenges, its growth seems to be retarded. This emerging material lacks enough support from the various E&P bodies due its observed cost and risk associated with the materials [5]. Also, the health, safety and environmental issues allied to the nanomaterial is still under debate and there is a little or no available technology to measure the toxicity of these materials to the environment. All the above summed up to be the various issues retarding the growth of the application of nanomaterial in the oil industry [6-8].

Conclusion

This paper summarized the various drilling and completion challenges faced in the oilfield. Also, the application of nanomaterials in solving the most of this related issue and the various factors retarding the growth of this technology was summarized. It can be concluded that the robustness of the nanomaterials give it the capacity to withstand and overcome various challenges faced during drilling and completion operation

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