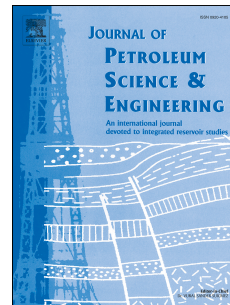


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Application Study of Nano-copper Based Composite Anti-friction Coating for Corrosion Resistant Couplings

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ABSTRACT: Copperized oil-coupling exhibits excellent anti-galling performance, but because of the economic and environmental issues, it can't be widely used in practical uses. A new method with good anti-galling performance, lower energy-needed and emission, more simple and inexpensive coupling method for corrosion resistant couplings is urgently needed.

A Nano-copper Based Composite Anti-friction Coating (AFRICO), which is the mixing of the high concentration of nano-copper suspension as the basic lubricant with some PTFE nano-particles and a special acrylic resin as a binder is presented here as a feasible alternative new method.

The full scale makeup and breakout experiments carried out on the non-API high grade P110S, N80S and TP95TS oil coupling couplings of the AFRICO treated separately showed, that the surfaces of the thread do not appear any obvious galling or scratches. That means the copperized couplings can be replaced by the AFRICO treated couplings in high grade steel corrosion resistant oil-couplings.

Keywords: nano-copper; anti-friction coating; corrosion resistant coupling; copper plating; anti-galling performance

1 Introduction

Oil country tubular goods (OCTGs) coupled by threaded connections play a vital position in the oil industry. The galling of the coupling is the most common damage failure in oil pipe application (Dong Changle et al., 2010; Ji Kangling, 2005). As hundreds of pipes and couplings are used in oil or gas wells, the severe galling of just only one coupling can result in big economic losses (O. Cuvalci et al., 2003; Zhang Yongjiang et al., 2008). Phosphating and copper plating on the surface of the coupling are the two main ways to prevent the coupling galling now. Phosphating treatment can effectively reduce the galling possibility of the coupling. But phosphating treatment has obvious selectivity to the material of oil coupling. Such as alloy steel, high chromium steel, stainless steel and nickel based alloys are not easy to use the phosphating treatment (Wang Shaolan et al., 2014).

Copper plating treatment is better than the phosphating treatment because of the good anti-galling performance and good bonding strength with the substrate (Du Chuanjun, 2001). The low hardness of the copper plating layer is advantageous for the lubricant and does not damage the steel matrix because of lubrication failure (Jaroslav Kovacik et al., 2008). For most manufactures, copper plating treatment is the preferred solution for galling of tubing and casing.

But copper plating treatment cannot be widely used because of the serious environmental pollution, high economic costs and complex production process etc. In addition, copper plating treatment cannot meet the sustainable environment policy. Therefore, it is very important to

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