Fluorinated Nitrile Elastomers for Drilling Applications

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ABSTRACT

Zinc bromide (ZnBr₂) brine used in drilling muds and completion solutions has high density for wellbore pressure control, but degrades typical nitrile elastomers. Surface fluorination of nitrile elastomers has been studied as a means to enhance the zinc bromide resistance, since fluorocarbon elastomers are compatible with ZnBr₂. However, the surface fluorination could introduce micro-cracks onto the nitrile surface, which has adverse effects on tensile properties. The present study found that these micro-cracks have no significant effects on shear or compression behaviors. Extrusion resistance tests showed the high level fluorination can enhance the nitrile’s extrusion resistance when exposed to ZnBr₂ at high temperature. In addition, the fluorinated NBR annular blowout preventer (BOP) increases its fatigue life cycles, which is attributed to the decreases in coefficient of friction of NBR due to fluorination.