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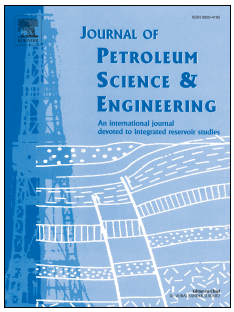

A novel star-shaped copolymer as a rheology modifier in water-based drilling fluids

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A novel star-shaped copolymer as a rheology modifier in water-based drilling fluids

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Abstract

Compared to linear polymers, star polymers have drawn significant research interest due to their excellent physical and rheological properties. In this paper, a star-shaped copolymer of acrylamide (AM) and 2-acrylamide-2-methyl-propanesulfonic acid sodium (AMPS) [S-poly(AM-co-AMPS)] is prepared using multifunctional macro-initiator, and serve as an additive to control the rheological and filtration performances of water-based drilling fluids. The results show that the yield point/plastic viscosity ratio (y_p/μ_p) of the formulated drilling fluids reaches a maximum value when the concentration of S-poly(AM-co-AMPS) is 0.3 wt%. Compared with the linear poly(AM-co-AMPS) having the similar molecular weight, S-poly(AM-co-AMPS) provides the drilling fluids with better shear-thinning characteristics and much lower apparent viscosities under non-aging and high-temperatures. In addition, the drilling fluids containing 0.3 wt% star copolymer show better resistance to cuttings contamination and shearing at high temperatures. The American Petroleum Institute (API) and High Temperature and High Pressure (HTHP) filtration tests indicate that the star-shaped copolymer can effectively reduce the filtration volumes. S-poly(AM-co-AMPS) shows better shearing resistance than the linear copolymer, which might contribute to better rheological performances of the drilling fluids formulated with only star copolymer while controlling the filtration performance.

Keywords: Star-shaped copolymer; Linear copolymer; Drilling fluids; Rheological properties; Filtration.

1. Introduction

To exploit oil, gas and geothermal resources, wells have to be dug to designed