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Rheological Properties of Nanoparticle Silica-Surfactant Stabilized Crude Oil Emulsions: Influence of Temperature, Nanoparticle Concentration and Water Volume Fraction"

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Oil in water emulsions occur during oil extraction due to the presence of water, naturally-occurring surface-active agents and mechanical mixing in pipelines or from oil spillage. Emulsions present difficulties for use of oil in fuel and their rheological properties are important to treat environmental impacts of spills. The objective of this study is to assess the rheological characteristics of oil in water emulsions stabilized by 5% NaCl brine, Tween 20 surfactant and silica nanoparticles to gain knowledge about the behavior of oil flow in pipelines and characterize them for environmental applications. Rheological behaviors such as shear rate, shear stress, and viscosity of Prudhoe Bay crude oil emulsions were analyzed with varying percent of water volume fractions (12.5, 25 and 50%), varying weight percent of silica nanoparticles (0.001, 0.01 and 0.1 weight %), with and without 2 CMC Tween 20 nonionic surfactant. Emulsions with varying water volume fractions were analyzed at 20, 40 and 60 degrees Celsius. Flow curve analysis of the emulsions was performed using an Anton-Paar rheometer. Preliminary findings indicate that increased temperature and increasing the concentration of nanoparticles both produced lower shear stress and that the addition of surfactant decreased the viscosity and shear stress of the emulsions.