

Chemistry of Iron Control Chemicals Used in Acid Stimulation Treatments

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Abstract

Iron complexing and reducing agents are used to prevent precipitation of iron compounds during acid stimulation treatments of oil, gas and water injection wells. Hydrochloric acid at concentrations up to 28 wt% is injected into carbonate formations to dissolve reservoir rock. High concentrations of iron can be dissolved by the reaction of the acid with corrosion products present in the steel tubing, or from iron-containing minerals that are present in sandstone formations. This dissolved iron can later precipitate as iron (III) hydroxide or iron sulfide (in sour wells). These precipitates can significantly impair well performance.

This paper first summarizes the chemistry of iron precipitation reactions that can occur during acidizing treatments of oil, gas and water injection wells. The behavior of iron complexing chemicals such as citric acid, acetic acid, EDTA, and NTA is examined at initial hydrochloric acid concentrations up to 28 wt%. Iron reducing agents, that convert iron (III) to iron (II), are also examined. The stability and degradation of these chemicals at temperatures up to 250 °F (121 °C) is discussed. With citric acid and NTA, unusual complexes containing iron/calcium/chelating agent in a 1/1/1 mole ratio were observed under certain conditions. Time-dependent precipitation behavior was noted with most of the complexing agents examined.

The impact of this work on oilfield acid stimulation operations is also discussed.

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