A Novel Imidazoline Derivative Used as an Effective Corrosion Inhibitor for Carbon Steel in a CO₂/H₂S Environment

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Thioureido-oleic acid imidazoline, TAI, is widely used in the oil/gas industry as an effective corrosion inhibitor to protect carbon steel pipelines from CO₂ corrosion. However, the inhibition efficiency is significantly reduced when H₂S gas coexists with CO₂. In this study, the imidazoline was modified by reaction with formaldehyde and propynyl alcohol to develop a modified imidazoline (MTAI). The inhibition performance was evaluated by dynamic weight loss, potentiodynamic polarization, contact angle, and scanning electron microscopy (SEM) measurements as well as quantum chemical calculations. Dynamic corrosion tests and polarization measurements show that the inhibition efficiency of MTAI is significantly better than that of TAI in a CO₂/H₂S environment. The contact angle measurements show that the MTAI inhibitory film is more hydrophobic than the TAI film. The quantum chemical calculations demonstrate that MTAI has two adsorption centres, which make the adsorption more stable and thus the inhibition more efficient.

Keywords: CO₂/H₂S corrosion; imidazoline; corrosion inhibitor; weight loss; polarization curve; contact angle; adsorption; quantum chemical calculation

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