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Characterization of the corrosion of oilwell cement exposed to H_2S under highsulfur gas reservoir conditions

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H_2S is an acidic and toxic gas and the corrosion of H_2S on oilwell cement is considered to be a great challenge for wellbore integrity and environmental safety in the exploitation of high-sulfur gas reservoir. In our work, an unidirectional sample was designed to simulate the actual downhole condition, and the corrosion performances of oilwell cement exposed to humid H2S gas and H_2S rich brine were investigated using designed unidirectional samples. Compressive strength, microhardness, porosity, gas permeability, SEM, EDS, and XRD analyses were conducted to compare the dissimilarity of H_2S attack in two exposure scenarios. The experimental results show that the corrosion degree of cement exposed to humid H_2S gas was lower due to a dense gypsum layer formed on the cement surface; this layer inhibited inward penetration of H_2S by blocking diffusion. On the contrary, a porous and loose amorphous silica gel section formed on the headspace of brine-exposed cement for dissolution and migration effects of brine, which facilitated the penetration of H_2S to the interior of cement. The degradation mechanism of cement and the effects of exposure scenario on cement properties are proposed.

Biography

Dr. Tao Gu obtained his B.Sc. in Polymer Materials and Engineering and M.Sc. in Matericals Science at Southwest Petroleum University (SWPU) in China in 2010 and 2013 respectively. In July 2016, he will be graduated from SWPU with a doctoral degree in Oil & Gas Well Engineering. In the past years, he has been working on Oil & Gas well cementing engineering. His current research interests include durability and corrosion of oil well cement under acid gas conditions and cementing materials and technology for oil-based drilling fluid conditions. Until now, he has published 5 patents applications and 8 papers.

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