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钻井工程

川渝地区含硫气井固井水泥环界面腐蚀机理分析

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摘要：

酸性气井井下防腐是石油工程学界的技术难题之一，对于"井筒第一屏障"——固井水泥环的腐蚀研究更是备受重视。针对目前井下固井水泥环腐蚀研究中存在的问题，采用界面腐蚀的试验方法，利用X射线衍射、扫描电镜等实验分析手段，对川渝地区含硫气井固井水泥环腐蚀机理进行了探索。结果表明：①水泥石的腐蚀深度和H_2S分压值、腐蚀时间成正比；②腐蚀后水泥石抗压强度值和H_2S分压值、腐蚀时间成反比；③由于水泥石受酸性气体腐蚀后的产物逐渐富集、堆积及运移，使水泥石形成一个较为稳定的致密层或腐蚀过渡带，腐蚀后水泥石的孔隙度和渗透率随腐蚀时间的增加呈现先增加后降低的特点，并最终使腐蚀介质进入水泥石内部变得更加困难；④确保水泥环在保持一定腐蚀深度的情况下，尽快形成较为稳定的腐蚀过渡带或降低水泥环的腐蚀速率，是含硫气井固井水泥环在酸性环境下保持长期密封性及化学完整性的重要基础条件。

关键词： 川渝地区 酸性气井 固井水泥环 界面腐蚀 腐蚀深度 孔隙度 渗透率抗压强度

Corrosion mechanism analysis of cement sheath interfaces of sour gas wells in Sichuan and Chongqing areas

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Abstract：

Corrosion control in sour gas wells is one of the technical challenges faced by petroleum engineering, so it has thus become rather important for the present studies to focus on the corrosion occurred on cement sheath as the first wellbore barrier. In view of the existing issues in such studies, corrosion tests were conducted on cement interface by use of X ray diffraction and electronic scanning in sour gas wells of Sichuan and Chongqing areas. The results demonstrate that (1) the corrosion depth into the cement stone is proportional to partial pressure of hydrogen sulfide and corrosion time; (2) the compressive strength of the corroded cement stone is inversely proportional to partial pressure of hydrogen sulfide and corrosion time; (3) due to the accumulation and migration of corrosion products from the reaction between the cement stone and the sour gas, the cement stone becomes a stable tight layer or a corrosion transition zone, the porosity and permeability of the corroded cement stone first increase and then decrease as corrosion time increases, and eventually, it becomes more difficult for the corrosion media to penetrate the cement stone, and (4) to maintain a certain corrosion depth inside the cement sheath and then to form a stable corrosion transition zone as quickly as possible, or to decelerate the corrosion rate inside the cement sheath, is the important guarantee for the cement sheath in the sour gas wells to get a good performance in longer sealing and chemical integrity.

Keywords：

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