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研究报告

预应变状态对J55油套管钢在长庆油田地下洛河水中腐蚀电化学性能的影响

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摘要: 利用电化学阻抗谱(EIS)和光电流技术研究了拉伸、压缩及弯曲三种状态下J55油套管钢在长庆油田洛河水中所成钝化膜电化学性能及光电特性。结果表明:随着拉应力的增加,传递电阻 R_1 、膜电阻 R_2 及扩散电阻减小,表明拉应力增加可使钝化膜对基体耐腐蚀的保护作用减弱;随着压应力和弯曲应力的增加,传递电阻 R_1 、膜电阻 R_2 及扩散电阻增加,说明在压、弯曲应力状态下钝化膜对基体的保护作用增强。Mott-Schottky曲线测试结果表明,拉应变程度增加,M-S曲线直线部分的斜率减小,说明钝化膜内的施主密度增加;而随着压、弯曲应力增加,M-S曲线直线部分的斜率增大,表明膜内的施主密度减小。光电流测试表明,光电流随着拉应变程度的增加而减小,随压缩和弯曲应变程度的增加而增大。

关键词: 应力状态 电化学阻抗谱(EIS) 钝化膜 Mott-Schottky曲线 光电流 长庆油田

EFFECT OF PRE-STRAIN STATES ON ELECTRONIC PROPERTY OF PASSIVE FILM ON J55 PIPELINE STEEL IN CHANGQING OILFIELD LUO-HE STRATUM WATER

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Abstract: The electronic property and photocurrent characteristics of passive films formed on J55 pipeline steel with tension, compression and bending stress conditions in the Changqing oilfield Luo-he stratum water were investigated through electrochemical impedance spectroscopy (EIS) and photocurrent techniques. The results showed that the transfer resistance R_1 , the film resistance R_2 and diffusion resistance decreased with the increase of the tension stress, and increased with the increase of the compression and the bending stress. It was shown that the protective effect of passive film on J55 pipeline steel was increased with the decreasing of the tension stress and the increasing of the compression and the bending stress. Mott-Schottky plots revealed that the slope of M-S plot decreased with the increasing of the tension stress and the decreasing of the compression and the bending stress, it can be concluded that the donor density of the passive film increased with increasing the tension stress and decreasing the compression and the bending stress. The photocurrent measurement indicated that the photocurrent decreased with the increasing of the tension stress and the decreasing of the compression and the bending stress.

Keywords: Stress condition Electrochemical impedance spectroscopy (EIS) Passive film Mott-Schottky plot Photocurrent the Changqing oilfield Luo-he stratum Water

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