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研究报告

缓蚀剂分子结构与抗硫性能及其缓蚀机理研究

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摘要: 用饱和 H_2S/CO_2 失重法、高压 H_2S/CO_2 动态失重法、原子力显微镜(AFM)、环境扫描电镜(SEM)和X射线能量色散光谱(EDX)研究了咪唑啉衍生物、曼尼希碱、吡啶季铵盐、喹啉季铵盐和新稠杂环季铵盐5种不同分子结构缓蚀剂对N80钢的抗硫性能。结果表明5种缓蚀剂对N80钢的抗硫性能均随缓蚀剂浓度的增加而增强,各缓蚀剂的抗硫性能优劣顺序为:新稠杂环季铵盐>喹啉季铵盐>吡啶季铵盐>咪唑啉衍生物>曼尼希碱。静电吸附作用较强、空间位阻效应较小且中心吸附原子的电子云密度较大的缓蚀剂抗硫效果更好,其缓蚀机理主要是有效抑制 CO_2/Cl^- 腐蚀且促使试片表面生成致密的硫化物保护膜。

关键词: 缓蚀剂 H_2S 分子结构 AFM SEM EDX

RELATIONSHIP BETWEEN CHEMICAL MOLECULAR STRUCTURE AND ANTI-SULFUR PROPERTIES AND INHIBITION MECHANISM OF CORROSION INHIBITORS

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Abstract: The inhibitive properties of five kinds of corrosion inhibitors, which contain imidazoline derivative, mannich base, pyridine quaternary ammonium salt, quinoline quaternary ammonium salt and a new fused heterocycle quaternary ammonium salt were studied by means of mass loss of saturated H_2S/CO_2 and dynamic rotating with high-pressure of H_2S/CO_2 , atomic force microscopy(AFM), environmental scanning electron microscope(SEM) and energy dispersive X-ray(EDX) analysis on N80 steel. The results showed that inhibitive properties of five kinds of inhibitors enhanced with the increase of their concentration. The excellent order of the inhibitors was as followed: the new fused heterocycle quaternary ammonium salt > quinoline quaternary ammonium salt > pyridine quaternary ammonium salt>imidazoline derivative>mannich base. Corrosion inhibitor which had stronger electrostatic adsorption, smaller steric hindrance effect and larger electron density of the adatom had the better anti-sulfur properties. The inhibition mechanism of corrosion inhibitor was to inhibit the corrosion of CO_2/Cl^- and spur the formation of the compact sulfide film.

Keywords: corrosion inhibitor hydrogen sulfide molecular structure AFM SEM EDX

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