

化学与环境

甲基丙烯酸酯-乙烯基吡啶-丙烯锌三元缔合型配位络合石油减阻剂的合成及其减阻和抗剪切性能的研究

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摘要:

配位络合石油减阻剂的主要合成方法为溶液聚合和乳液聚合, 为确定最佳聚合方法, 以甲基丙烯酸和正十二醇合成了较纯的甲基丙烯酸十二酯。以苯乙烯与合成的甲基丙烯酸十二酯为原料、4-乙烯基吡啶和甲基丙烯锌为聚合极性单体, 分别采用溶液聚合和乳液聚合的方法合成了缔合型配位络合石油减阻剂。利用红外谱图表征了缔合型配位络合石油减阻剂分子的结构, 用热分析仪与动态光散射粒度分析仪对减阻聚合物进行了表征测试, 采用减阻剂减阻效果环道测试评价系统, 分别对两体系进行了减阻性能与抗剪切性能的比较研究。研究结果表明: 两种方法均可获得有效的缔合型配位络合石油减阻剂, 但是乳液聚合产物的流体力学半径更大, 玻璃化转变温度 (glass transition temperature, TG) 更高, 表明缔合作用更强, 减阻和抗剪切性能均优于溶液聚合产物, 同时乳液聚合得到的减阻剂产率较高, 因此缔合型配位络合石油减阻剂的最佳聚合方法是乳液聚合。

关键词: 溶液聚合 乳液聚合 配位络合 减阻率 抗剪切性能 减阻剂

Study of the synthesis and properties of drag reduction and anti-shearing stability of coordination compound oil reducers based on lauryl methacrylate-vinyl pyridine-zinc dimethacrylate

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Abstract:

Solution polymerization and emulsion polymerization are the main methods for synthesizing the coordination compound oil reducers. In order to select the best method for synthesizing the coordination compound oil reducers, lauryl methacrylate was first prepared from methacrylic acid and dodecanol. Then the coordination compound oil reducers were respectively synthesized by the solution polymerization method and emulsion polymerization method, and using styrene and synthesized methacrylate as the raw material, 4-vinyl pyridine and zinc dimethacrylate as polar monomers. The molecular structures of the coordination compound oil reducers were characterized by infrared spectrum, and the drag reducers were also examined by thermal analysis instrument and VISCOTEK DLS. The association of the drag reducers synthesized by the mentioned different methods were further confirmed and compared. The drag reduction rate and the properties of anti-shearing on different methods were examined. Finally, the conclusion showed that the effective coordination compound oil reducers could be synthesized by the solution polymerization method and emulsion polymerization method, while the product of emulsion polymerization was better than that of solution polymerization from the prospective of getting larger hydrodynamics radius and glass transition temperature, which showed that the product of emulsion polymerization had a more stable association. The results indicated that the product of emulsion polymerization had a more stable association, preferable drag reduction and anti-shearing force, which showed that the best method was emulsion polymerization.

Keywords: solution polymerization emulsion polymerization coordinated complexation drag reduction rate anti-shearing stability reducer

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