



论文摘要

中南大学学报(自然科学版)

ZHONGNAN DAXUE XUEBAO(ZIRAN KEXUE BAN)

Vol.41 No.1 Feb.2010

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文章编号: 1672-7207(2010)01-0090-07

高固体含量水性聚氨酯丙烯酸酯复合乳液的合成与性能

李韶茂, 瞿金清, 陈焕钦

(华南理工大学 化学与化工学院, 广东 广州, 510640)

摘要: 采用偶氮二异丁腈(AIBN)为引发剂, 阴离子聚氨酯水分散体(PUD)为乳化剂和反应物, 与甲基丙烯酸甲酯(MMA)和丙烯酸丁酯(BA)通过乳液共聚制备高固体含量聚氨酯丙烯酸酯复合乳液(PUA)。研究提高PUA乳液固体含量的途径, 讨论单体种类和添加量对PUA乳液与涂膜性能的影响, 并采用热重分析(TGA)和傅里叶红外光谱(FT-IR)对PUA涂膜的热稳定性和结构进行表征。研究表明: 将PUD/丙烯酸酯单体以6 000 r/min的转速分散20 min, 在70 °C热聚合1-2 h, 后期追加单体质量分数为0.70%的AIBN能提高PUA乳液的固体含量达45%以上; 在 $m(\text{PUD})/m(\text{单体})=11.2$; $m(\text{MMA})/m(\text{BA})=1:2$ 条件下合成的PUA涂膜拥有优异涂膜性能: 涂膜的吸水率为15.5%, 吸碱率为7.9%, 吸醇率为28.9%, 摆杆硬度为0.75和耐低温冷脆性(-20 °C, 3 d, 涂膜不开裂); MMA与BA复合能明显提高PUA涂膜热稳定性。

关键字: 聚氨酯丙烯酸酯复合乳液; 高固含量; 耐水性

Synthesis and properties of high solid contents polyurethane-acrylate hybrid emulsions

LI Shao-mao, QU Jin-qing, CHEN Huan-qin

(School of Chemistry and Chemical Engineering, South China University of Technology, Guangzhou 510640, China)

Abstract: High solid contents waterborne polyurethane-acrylate hybrid emulsions (PUA) were synthesized by emulsion copolymerization of aqueous polyurethane dispersion (PUD) and acrylic monomers including methyl methacrylate (MMA) and butylacrylate (BA) in the presence of azodiisobutyronitrile (AIBN) using PUD as an emulsifier and a reactant. The preparation methods of high solid contents emulsions were investigated. The effects of monomer categories and contents on the PUA properties were studied. Meantime, the structures and properties of PUA were characterized by FTIR spectra and thermal gravimetric analysis (TGA). The results show that PUA emulsions with high solid contents up to 45% are obtained when PUD/monomers are dispersed at 6 000 r/min rotation speed for 20 min and thermal polymerized at 70 °C for 1-2 h and 0.70% AIBN is added as a post-addition initiator. PUA films display good performance including 15.5% water absorption, 6.9% alkali absorption, 22.6% ethanol absorption, 0.75 hardness, and good low temperature crack-resistance (-20 °C, 72 h, film surface no crack) when the mass ratio of PUD/monomers and MMA/BA are 11.2: and 1:2, respectively. The PUA films containing MMA and BA display good thermal stability.

Key words: polyurethane-acrylate hybrid emulsion; high solid content; water-resistance

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地 址：湖南省长沙市中南大学 邮编： 410083

电 话： 0731-88879765 传真： 0731-88877727

电子邮箱： zngdx@mail.csu.edu.cn 湘ICP备09001153号