

基于席夫碱自修复聚合物的制备及性能

中文摘要

摘要：席夫碱主要是指含有亚胺或甲亚胺特性基团（ $-RC=N-$ ）的有机化合物^[1]，通常是由活性羰基和胺进行缩合而制成席夫碱的， $C=N$ 键长约 $0.124\sim 0.128\text{nm}$ ，偶极矩约 0.90D 。席夫碱相关的反应有诸多的优点，譬如合成过程简单、成本低、来源广泛、含有动态可逆过程等。

本实验以壳聚糖溶入醋酸以及蒸馏水制成混合溶液后，用磁力子搅拌子不间断的进行至少三小时的搅拌，直至壳聚糖完全溶解。再往壳聚糖混合溶液中加入对苯二甲醛和聚乙烯亚胺，继续进行搅拌至对苯二甲醛以及聚乙烯亚胺完全溶解，得到席夫碱聚合物，并研究其自修复情况。

本实验对所合成的席夫碱聚合物进行结构表征。而席夫碱聚合物的红外光谱分析方面是通过红外分光光度计记录得到相关方面的数据。席夫碱聚合物的机械性能测试主要是对拉伸力学性能的测试。拉伸力学性能的测试是在微型控制电子万能试验机上进行的，其测试的温度基本为室温，所有参与拉伸力学性能的测试都是在样品制备 24 小时后进行的，做出不同聚合物薄膜的应力-应变曲线。在席夫碱聚合物的热性能测试中，玻璃化转变温度是非常重要的参数，在席夫碱聚合物薄膜的表面划出一道划痕，在光学显微镜下仔细观察处于控温台上席夫碱聚合物薄膜表面划痕的变化。探讨席夫碱键含量及交联度、修复温度、修复时间对聚合物薄膜修复效率、力学性能等的影响，并同时用显微镜观察席夫碱聚合物薄膜的修复情况。

关键词：席夫碱；自修复；聚合物薄膜；结构表征；拉伸力学性能；修复效率

Abstract

Abstract : Schiff base mainly refers to an organic compound containing an imine or methylimine characteristic group ($\text{-RC}=\text{N-}$)^[1], which is usually made by the condensation of an active carbonyl group and an amine to make a Schiff base, $\text{C}=\text{N}$. The bond length is about $0.124 \sim 0.128\text{nm}$, and the dipole moment is about 0.90D . Schiff base-related reactions have many advantages, such as simple synthesis, low cost, wide source, and dynamic reversible processes.

In this experiment, chitosan was dissolved in acetic acid and distilled water to make a mixed solution, and a magnetic stirrer was used to continuously stir for at least three hours until the chitosan was completely dissolved. Then add terephthalaldehyde and polyethyleneimine to the chitosan mixed solution, and then continue stirring until the terephthalaldehyde and polyethyleneimine are completely dissolved to obtain the Schiff base polymer, and study its self-repair situation.

In this experiment, the synthesized Schiff base polymer was structurally characterized. The infrared spectrum analysis of the Schiff base polymer is recorded by infrared spectrophotometer. The mechanical property test of Schiff base polymer is mainly to test the tensile mechanical property. The tensile mechanical properties are tested on the CMT4304 micro-control electronic universal testing machine. The test temperature is basically room temperature. All the tests involved in the tensile mechanical properties are performed after 24 hours of sample preparation to make different polymers. The stress-strain curve of the film. In the thermal performance test of Schiff base polymers, the glass transition temperature is a very important parameter. A scratch is drawn on the surface of the Schiff base polymer film, and the Schiff base on the temperature control table is carefully observed under an optical microscope. Changes in scratches on the surface of polymer films. The effects of Schiff base bond content, crosslinking degree, repair temperature, and repair time on the repair efficiency and mechanical properties of polymer films were discussed. At the same time, the repair situation of Schiff base polymer films was observed with a microscope.

Key Words : Schiff base; self-repair; polymer film; structural characterization; tensile mechanical properties; repair efficiency

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