

研究论文

温敏聚氨酯软段的结晶行为及其智能响应特性

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摘要: 采用两步溶液共聚技术制备了一种温敏聚氨酯材料, 并对其软段的结晶行为以及智能响应特性和机理进行了分析。结果表明: 温敏聚氨酯具有典型的嵌段和微相分离结构, 软段和硬段各具独立的结晶熔融转变温度(软段的结晶熔融转变温度定义为开关温度), 且软段的结晶具有较好的热致可逆性。当温度低于开关温度时, 软段具有完整的结晶形态, 温敏聚氨酯膜的内部自由体积孔洞尺寸和透汽性均较低; 当温度高于开关温度时, 软段结晶完全熔融、消失, 同时膜的内部自由体积孔洞尺寸和透汽性均明显增大, 显示了温敏特性。温敏聚氨酯软段的相态转变决定材料的智能响应特性, 并且这一过程可通过外界温度的改变加以控制。

关键词: 智能材料 聚氨酯 结晶行为 温敏特性

The Crystallization of Soft Segment of Thermal Sensitive Polyurethane and Its Intelligent Properties

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Abstract: A thermal sensitive polyurethane (TSPU) membrane was prepared by two-step polymerization in solvent and the crystallization of soft segment was analyzed. The results reveal that TSPU shows an obvious phase-separated structure and a phase transition temperature of the soft segment (defined as switch temperature, T_s). The switch temperature (T_s) and the thermal sensitivity of TSPU still remain available after thermal cyclic process. Moreover, when the temperature was lower than the T_s , the crystal of the soft segment was visible, but when the temperature exceeded the phase transition temperature of soft segment, the crystal of the soft segment melted and disappeared. As a result, the average radius (R) of the free volume holes and water vapor permeability of TSPU membrane showed a response to thermal stimuli. The phase transition of the soft segment controlled the significant change in free volume hole size and WVP, and the process mentioned above was stimulated by the external temperature.

Keywords: intelligent materials polyurethane crystallization thermal sensitivity

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