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论文

聚醚链段长度对氨基聚醚-环氧树脂力学性能的影响

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摘要:

以柔性端氨基聚醚(BATPE)和双酚A环氧树脂(DGEBA)为原料, 制备了无微相分离结构的无定型AB交联热固性树脂. 测试了3种不同聚乙二醇(PEG)链段长度(M_{PE})的BATPE-DGEBA环氧树脂固化产物的应力-应变曲线、动态力学温度谱和冲击断面形貌. 结果表明, 在环氧树脂交联网络中引入两端与DGEBA化学连接的PEG链段能避免微相分离结构的生成, 有利于提高DGEBA链段的应变松弛速率. 增加M_{PE}, 一方面能降低环氧树脂固化产物的玻璃化转变温度和室温下的刚度和拉伸强度, 增加韧性(包括冲击强度和拉伸韧性)、断裂应变和模量损耗因子; 另一方面也能提高固化产物在低温下的储存模量. 优化M_{PE}可制备出在中低温下同时具有优异的拉伸强度、模量、断裂应变和冲击性能的BATPE-DGEBA环氧树脂.

关键词: 环氧树脂; 端氨基聚醚; 微相分离; 力学性能; 动态力学温度谱

Influence of Polyether Segment Length on Mechanical Properties of Cured Epoxy Resins Based on Amino-terminated Poly(ethylene glycol) and Diglycidyl Ether of Bisphenol

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Abstract:

An advanced amorphous AB-type thermosetting resin without nanophase separation was synthesized via directly moulding diglycidyl ether of bisphenol A(DGEBA) and *α,ω*-bisaminophenyl terminated poly(ethylene glycol)(BATPE). The stress-strain curve, dynamic mechanical thermal analysis and morphologies of impact fracture surfaces of the cured products were investigated as functions of flexible poly(ethylene glycol) segment length(M_{PE}). The results show that the homogeneous epoxy resin without nanophase separation are available by incorporating poly(ethylene glycol) segments into epoxy crosslinked networks *via* chemically linked with DGEBA at both terminals, beneficial for increasing free volume fractions and strain relax rates. When M_{PE} is extended, the glass transition temperature, the room-temperature Young′s modulus and tensile strength of the cured products decrease while toughness, elongation and modulus loss factors increase. The elastic mo-dulus of the cured products at low temperature(*i.e.* -40 ℃) enhances with increasing M_{PE}. Consequently, thermosetting epoxy resins based on BATPE-DGEBA which exhibits excellent tensile strength, modulus and impact strength at moderate and low temperature are obtained by facile optimization of M_{PE}.

Keywords: Epoxy resin; Amine-terminated polyether; Nanophase separation; Mechanical property; Dynamic mechanical thermal analysis

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