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论文

具有包藏结构的三元聚丙烯纳米复合材料结构与性能关系的研究

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摘要 制备了一种新型聚丙烯/丁苯橡胶/纳米碳酸钙三元纳米复合材料, 研究结果显示, 复合材料中的大多数纳米碳酸钙粒子被包藏在丁苯橡胶中, 并与之共同形成分散于聚丙烯树脂中的分散相, 这种聚丙烯纳米复合材料具有高刚性、高韧性、高耐热性和高的结晶速率。系统研究了成核剂苯甲酸钠的加入和纳料碳酸钙的用量对该类纳米复合材料相态结构、结晶形态和结晶动力学的影响, 以及具有包藏结构的分散相粒径和PP中β晶含量对材料性能的影响, 结果表明, 苯甲酸钠的加入和纳米碳酸钙用量的提高均可使体秒中分散相粒径减小, 结晶速率加快, 进而使材料的韧性、刚性和耐热性提高。

关键词 聚丙烯 纳米碳酸钙 纳米复合材料 包藏结构 结晶

分类号

STUDIES ON THE RELATIONSHIP BETWEEN STRUCTURE AND PROPERTIES FOR TERNARY PP NANOCOMPOSITES WITH SPECIAL “SALAMI” LIKE STRUCTURE

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Abstract Addition of elastomer to PP can greatly improve its impact resistance,but at the cost of decrease in properties like stiffness and heat resistance. Introduction of inorganic particles into PP can lead to faidy high stiffness,but at the cost of lower fracture toughness. Therefore,to improve the overall performance of PP,a ternary blending method of PP with both rigid inorganic particles and soft elastomefic inclusions has attracted much attention because of its potentiality in achieving both high stiffness and high toushness. A new ternary nanocomposite of PP/styrene-butadiene rubber/nano-$CaCO_3$ was prepared by melt-blending,and its properties and crystallization behavior were investigated. TEM photographs show that the nanocomposite has a“sea-island”microstructure with a“salami” like structure in the dispersion phase,where the nano-$CaCO_3$ particles are embedded in styrene-butadiene rubber particles,This unique phase structure gives the PP nanocomposite excellent pmperties in impacl resislance,stiffness, heat resistance and crystallization rate. Also studied were the effect of the introduction of sodium benzoate and the content of nano-$CaCO_3$ on the ternary PP nanocomposite’s phase structure. crystal form and crystallization kinetics and the effect of the particle size of dispersion phase and the content of βcrystal on the nanocomposite’s properties. It was found that increase of the content of nano-$CaCO_3$ particles and introduction of sodium benzoate into PP ternary system lead to a decrease of the dispersion phase particle size within PP matrix and a great increase of crystallization rate,and consequently result in the remarkable improvement of impact resistance,stiffness and heat resistance of the PP composite.

Key words Polypropylene Nano-$CaCO_3$ Nanocomposite “Salami” like structure Crystallization

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