

论文

软质聚氯乙烯分子网络及其Gaussian模量

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摘要:

采用应力松弛实验及Haward模型, 研究了增塑剂含量、填料[CaCO₃、炭黑(CB)]和丁腈橡胶(NBR)对软质聚氯乙烯(PPVC)的分子链缠结网络结构、分子链滑移及Gaussian模量的影响. 结果表明, 在PPVC主网络达到极限伸长之前, PPVC材料的粘弹行为能很好地符合Haward模型. 增塑剂、CaCO₃和CB虽然不改变主网络的缠结结构, 并且主网络的极限伸长不变, 但增塑剂可以降低主网络的网链密度, 而CaCO₃和CB可以提高主网络的网链密度; 同时增塑剂可减弱次级网络, 增大PVC分子链滑移, 使材料的Gaussian模量下降; CaCO₃和CB可增强次级网络, 减小PVC分子链滑移, 使材料的Gaussian模量增加. NBR的加入可以改变主网络的缠结结构, 增加主网络的极限伸长; 既可降低PPVC主网络的缠结密度, 又可减弱次级网络, 使Gaussian模量降低.

关键词: 软质聚氯乙烯 分子网络结构 Gaussian模量 增塑剂 填料 丁腈橡胶

Molecular Network Structure and Gaussian Modulus of Plasticized Poly(vinyl chloride) Material

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Abstract:

The influences of the content of plasticizer, filler(CaCO₃, carbon black) and *n*-butyl nitrile rubber(NBR) on the network structure, molecular slippage and Gaussian modulus of plasticized poly(vinyl chloride) (PPVC) were studied by employing stress relaxation experiment and Haward model. The network structure of PPVC comprises the main network formed by macromolecule entanglement and the secondary network formed by interaction forces between molecule(van der Waals force). The viscoelastic behavior of PPVC materials is in accordance with Haward model before their main networks extend to the critical value. Although plasticizer, CaCO₃, carbon black do not change the entanglement structure of PPVC, plasticizer can decrease Gaussian modulus and increase the molecular slippage by decreasing the density of main network and weakening the secondary network. However, CaCO₃ and carbon black can increase Gaussian modulus and decrease the molecular slippage by increasing the density of main network and strengthening the secondary network. NBR not only decreases the entanglement density of macromolecular chain but also weakens the secondary network, which results in the reduction of Gaussian modulus of PPVC material.

Keywords: Plasticized poly(vinyl chloride) Molecular network structure Gaussian modulus Plasticizer Filler Nitrile rubber

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