VISCOELASTIC MODELING OF EXTRUDATE SWELL OF ACRYLONITRILE-BUTADIENE-STYRENE/CLAY NANOCOMPOSITE

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ABSTRACT:
The aim of the present work was to predict the extrudate swelling behavior of organoclay containing Acrylonitrile-Butadiene-Styrene (ABS) nanocomposite. The modeling was performed on the basis of unconstrained recovery concept originally introduced by Tanner but employing Wagner viscoelastic model with generalized Wagner damping function which is believed to be capable of taking into account the effect of organoclay on viscoelastic properties of nanocomposite sample. This approach enabled us to evaluate the effect of organoclay on extrudate swell in terms of disentanglement kinetics and chain relaxation behavior. In our modeling, the effect of die entrance region on the extent of extrudate swelling was also considered. In order to evaluate the validity of our modeling, the extrudate swell was measured as a function of wall shear stress for samples varying in organoclay content. The results predicted from the model were found to be in relatively good agreement with the experimental results.

ZUSAMMENFASSUNG:
Das Ziel der vorliegenden Arbeit war, die Strangaufweitung von Acrylnitrilbutadien (ABS)-Copolymer/Organoclay-Nanokompositen vorherzusagen. Die Modellierung wurde auf Basis des von Tanner eingeführten Konzeptes der freien Erholung durchgeführt, wobei aber das viskoelastische Modell von Wagner mit der verallgemeinerten Dämpfungsfunktion verwendet wurde, die den Einfluss des Organoclays auf die viskoelastischen Eigenschaften der Proben berücksichtigen kann. Dieser Ansatz dient, den Einfluss des Organoclays auf die Strangaufweitung bei der Entschlaufungskinetik und dem Kettenrelaxationsverhalten zu erfassen. In unserem Modell wurde der Effekt der Düseneinlaufregion auf die Strangaufweitung ebenfalls betrachtet. Um die Gültigkeit unseres Modells zu evaluieren, wurde die Strangaufweitung als Funktion der Scherspannung an der Wand für unterschiedliche Organoclay-Gehalte gemessen. Die Resultate unseres Modells sind in relativ guter Übereinstimmung mit den experimentellen Ergebnissen.

RÉSUMÉ:
Le but du présent travail était de prédire l'extrudat comportement de gonflement argile contenant de l'acrylonitrile-butadiène-styrène (ABS)nanocomposite.La modélisation a été effectuée sur la base du concept de recouvrement sans contrainte introduite à l'origine par Tanner, mais en utilisant le modèle viscoélastique avec Wagner généralisé Wagner amortissement fonction qui est censé être capable de prendre en compte l'effet de argile sur les propriétés viscoélastiques de l'échantillon nanocomposite.Cette approche nous a permis d'évaluer l'effet de la houle sur argile extrudée en termes de cinétique désenchevêtrement et le comportement de relaxation de la chaîne.Dans notre modélisation, l'effet de la région entrée de la filière sur l'ampleur du gonflement extrudat a également été pris en considération. la houle extrudat a été mesurée en fonction de la contrainte de cisaillement de paroi pour des échantillons différents de la teneur en argile.

KEY WORDS: Extrudate Swell, nanocomposite, organoclay, rheology, relaxation

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ically at high shear stress region (above 2×10^5 Pa). A slight deviation from experiment at low shear stress region could be attributed to the way we adjusted the model parameters and/or discarding the effect of the second normal stress difference. The experimental errors involved with the extrudate swell measurement at low shear rate region could also cause this deviation. The proposed model capability in predicting the extrudate swell was also supported by the experimental results reported for Polyamide and high impact Polyamide samples.

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