EFFECT OF INTERMOLECULAR INTERACTIONS ON PHASE COMPATIBILITY AND MATERIAL PROPERTIES IN ORGANIC-INORGANIC COMPOSITE BLENDS

Adina Maria Dobos[1], Anca Filimon[1], Adriana Popa[2*]

[1]Department of Physical Chemistry of Polymers,"Petru Poni" Institute of Macromolecular Chemistry, Aleea Grigore Ghica Voda 41 A, 700487 Iasi, Romania
[2]"Coriolan Drăgulescu" Institute of Chemistry, 24 Mihai Viteazul Blv., 300223, Timisoara, Romania
[*]e-mail: apopa_ro@yahoo.com

Abstract

The concentred solutions of cellulose acetate (CA) in tetrahydrofuran (THF) with different content of tetraethyl ortosilicate (TEOS) (1.0-2.0 (wt.%/wt.%)) were analyzed in terms of the intermolecular interactions by dynamic viscometric measurments and Fourier-transform infrared spectroscopy (FTIR) analysis. For all studied systems the flow behavior is guverned by hydrogen and covalent bonds that have an impact on the dynamic viscosities and flow activation energy (Ea), implicitly. Thus, was observed that the flow activation energies increase with the increasing of TEOS content in CA solutions. This means that, besides to polymer/solvent interactions, which established between the cellulose acetate and tetrahydrofuran, new hydrogen and covalent bondings generated by silanol groups of TEOS and -OH groups of CA occurs, leading to an increase in Ea (Fig. 1).

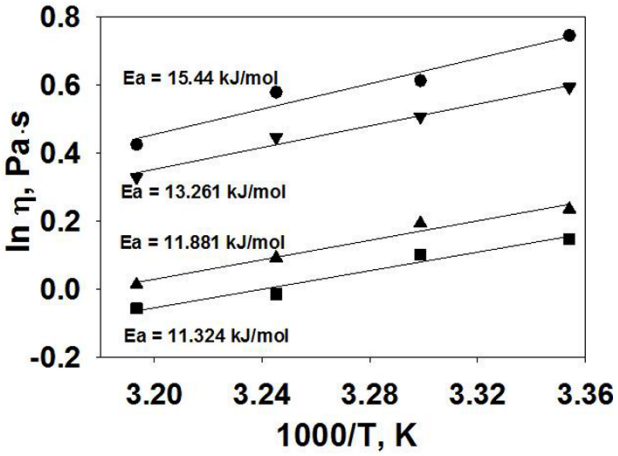

Fig. 1. Plot of ln □ *versus* 1000/T for CA/TEOS blends at different mixing ratios: (■) CA, (▲) CA/1wt.% TEOS, (▼) CA/1.5wt.% TEOS, (●) CA/2wt.% TEOS.

A higher value of Ea corresponds to a low polymer flexibility which slows the flow process and determines the appearance of gel behavior. In addition, SiO_2 resulting from the hydrolysis and condensation of TEOS, which take place during the process of the solutions obtaining, may generates crosslinking points in the polymeric systems, increasing its rigidity and leading to high values of Ea. These results are also reflected in FTIR spectra of the films corresponding to the solutions rheological analyzed, where the shape and intensity of the peaks confirm the occurrence of some additional interactions with increasing of TEOS content in CA casting solution. It was demosntrated thus, that, for a TEOS content less than 1.00 wt.%/wt.% and greater than 1.5 wt.%/wt.%, the intermolecular interactions prevent the formation of films/membranes.

Consequently, the results of this study are essential in different fields of applicability, considering the intermolecular interactions impact in the process of the supramolecular structures obtaining.