



Contribution ID: 29

Type: poster presentation

Polymer dynamics and morphology in LDPE nanocomposites studied by NMR spectroscopy and relaxometry

Tuesday 4 July 2017 19:10 (2 hours)

Low density polyethylene (LDPE) is commonly used for food packaging [1]. The addition of nano-clays often improves the mechanical, thermal and gas-barrier properties of the polymer matrix, making the composite a potentially superior industrial product.

In this work, solid state NMR spectroscopy and ^1H NMR relaxometry techniques were applied to a neat LDPE and a LDPE/montmorillonite nanocomposite sample [2] in order to investigate the effect of the filler on polymer morphology and dynamics, molecular level properties which are related to the mentioned macroscopic properties.

The studied LDPE sample showed a glass transition at -45°C and a melting point at 114°C . The analysis of ^1H low field NMR Free Induction Decays in the temperature range between 26 and 100°C allowed three components with different mobility to be identified: crystalline, amorphous, and rigid amorphous fractions. ^{13}C direct excitation NMR spectra were also recorded at room temperature to further characterize these fractions. In addition, in order to get insight into the phase heterogeneity we measured the ^1H longitudinal relaxation times in the laboratory frame (T_1) at 300 MHz and in the rotating frame ($T_{1\rho}$) using ^{13}C detection through Cross Polarization Magic Angle Spinning (CP MAS) at room temperature and performed spin diffusion experiments. Moreover, the chain segmental and collective dynamics was characterised by measuring ^1H T_1 at Larmor frequencies ranging from 10 kHz to 30 MHz, exploiting a Fast Field-Cycling NMR relaxometer in the $26\text{--}120^\circ\text{C}$ temperature interval. The results obtained for the neat polymer and the nanocomposite were compared and discussed.

References

[1] Ray, S.; Quek, S. Y.; Easteal, A.; Chen, X. D. *Int. J. Food Eng.* 2006, **2**(4), art. 5.

[2] Coiai, S.; Scatto, M.; Bertoldo, M.; Conzatti, L.; Andreotti, L.; Sterner, M.; Passaglia, E.; Costa, G.; Ciardelli, F. *e-Polymers* 2009, **9**, 606-623.

Authors: Dr CALUCCI, Lucia (ICCOM-CNR); Dr PIZZANELLI, Silvia (ICCOM-CNR)

Co-authors: Mr MASSA, Carlo Andrea (IPCF-CNR); Dr FORTE, Claudia (ICCOM-CNR)

Presenter: Dr CALUCCI, Lucia (ICCOM-CNR)

Session Classification: Poster Session

Track Classification: Soft matter and glass formers