Control of thermal degradation of PET/clay nanocomposites by chain extension reaction

Pierre J. Carreau[a], Abbas Ghanbari[a], Marie-Claude Heuzey[a], Minh-Tan Ton-That[b]

[a] *Center for Applied Research on Polymers and Composites (CREPEC), Chemical Engineering Department, Ecole Polytechnique de Montreal, PO Box 6079, Stn Centre-Ville, Montreal, QC H3C 3A7, Canada*
[b] *Industrial Materials Institute, National Research Council Canada, 75 Mortagne Blvd, Boucherville, QC J4B 6Y4, Canada*

(pcarreau@polymtl.ca www.polymtl.ca)

Polyethylene terephthalate (PET) undergoes severe thermal, oxidative, hydrolytic, and mechanical degradation during melt processing[1]. The organoclays accelerate chain scission of the PET matrix which leads to a matrix of a lower molecular weight[2]. In this work we employed a multifunctional epoxy based chain extender to rebuild the molecular weight as epoxide can form covalent bonds with the nucleophilic end groups of PET during the limiting time of extrusion. Joncryl® ADR 4368 (Joncryl) was used as the chain extender and Cloisite® 30B (C30B) and Nanomer® I.28E (N28E) were employed as organoclays. Figure 1 shows the complex viscosity and storage modulus as functions of frequency for the neat PET and PET nanocomposites with and without Joncryl. The addition of 1 wt% Joncryl during extrusion increased the complex viscosity of the neat PET from 400 Pa.s to more than 2000 Pa.s at low frequencies. All nanocomposites exhibit a shear-thinning behavior and the presence of the chain extender increased the complex viscosity and storage modulus of all samples. A gel content test was performed at room temperature to examine the probability of gelation or cross-linking in samples containing Joncryl. All samples were completely dissolved in a mixture of 60/40 wt% phenol and tetrachloroethane at room temperature within 30 min confirming that the samples containing the chain extender had no cross-linking. Extensive results on the effect of Joncryl on the rheological properties of PET and PET clay nanocomposites will be presented and discussed in light of the reaction mechanisms between PET and the chain extender.

References

1. N. Torres, J. J. Robin and B. Boutevin, Journal of Applied Polymer Science 79:1816-1824 2001.
2. A. Ghanbari, M. Heuzey, P. Carreau and M. T. Ton-That, Polymer International (In press).

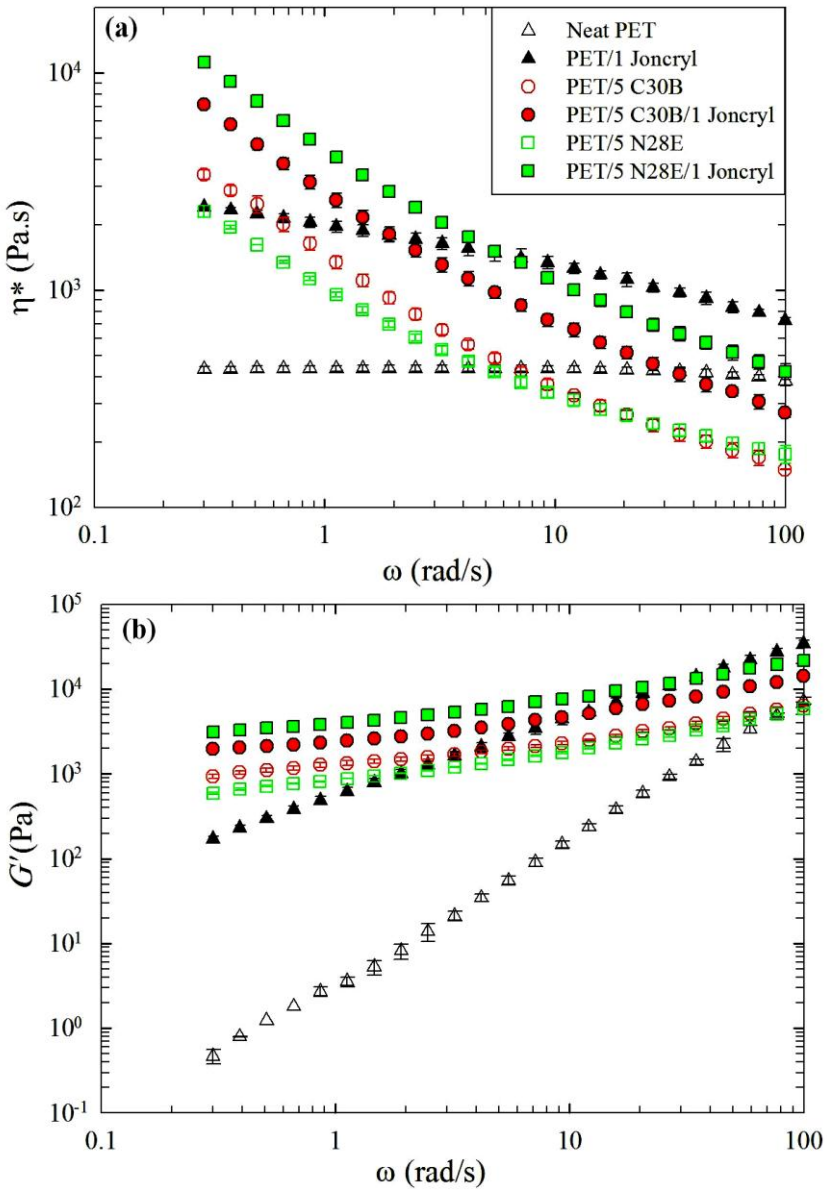

Figure 1 Complex viscosity (a) and storage modulus (b) as functions of frequency for the neat PET and PET nanocomposites with and without Joncryl.