# Physical aging and its effect on mechanical properties of toughened PLA films

Sandra Domenek*[1], Alain Guinault[2], and Cyrille Sollogoub†[2]

[1]Paris-Saclay Food and Bioproduct Engineering – AgroParisTech, Université Paris-Saclay, Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement – France
[2]Laboratoire Procédés et Ingénierie en Mécanique et Matériaux – Conservatoire National des Arts et Métiers [CNAM], Centre National de la Recherche Scientifique, Arts et Métiers Sciences et Technologies – France

**Résumé**

Physical properties of amorphous poly(D,L-lactide) (PLA) and blends whith poly(hydroxybutyrate-co-hydroxyvalerate) (PHBV) and/or palm oil deodorization condensate (PODC), a novel toughening agent, were investigated during aging. In the glass transition region, differential scanning calorimetry (DSC) showed volume relaxation of PLA and blends, inducing increase with the aging time of both enthalpy loss ($\delta$H) and peak endothermic temperature (Tp). Kinetics parameters were determined: PODC appeared to slow down the PLA relaxation while PHBV had no significant impact. Tensile tests showed that PLA and blends underwent with aging time a drastic loss of ductility and an increase in rigidity. After some hours ($\approx$ 48 h), while neat PLA turned ductile to brittle, PLA/PHBV blend retained an acceptable elongation at break ($\approx$ 25 %) while an important and stable ductility ($\approx$ 130 %) was shown for PLA/PODC/PHBV. Scanning electron microscopy observations of the stretched samples surfaces allowed to highlight an aging induced change in the deformation mechanism. While homogenous shear deformation is predominant for unaged samples, physical aging induced a gradual change from shearing to crazing by the addition of PHBV and PODC which largely promote the crazing deformation mechanism.

*Intervenant
†Auteur correspondant: cyrille.sollogoub@lecnam.net