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# Effect of Organically Modified Silicate Layers on the Morphology and Mechanical Properties of a Poly (Butylene Adipate-co-Terephthalate) and Poly (Lactic acid) Blend

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**Abstract** – Dispersion of organically modified clay in the blend of PLA and PBAT and its effect on the morphology, and the thermal and mechanical properties of the blend were studied. Mechanical strength of the blend was enhanced and the morphology of the blend was affected due to the clay's presence.

This work investigates the dispersion of organically modified silicate layers known as organoclay in the blend of Poly(butylene adipate-co-terephthalate) (PBAT) and Poly(lactic acid) (PLA) and its effect on the morphology, and the thermal and mechanical properties of the blend. Modifying the properties via blending with other polymers is a cost-effective method for developing new materials with desired properties for a particular application. Advancements in processing and modification of biodegradable plastics make them capable of competing effectively with non-biodegradable materials. PBAT with elongation at break close to 700% is an appealing biodegradable polymer for several applications, but it has a relatively low tensile strength. Blending PBAT with PLA, a biodegradable polymer from renewable resources, would reduce the cost and dependency upon non-renewable resources for the ultimate blend. In addition, nano-structured particles such as organically modified silicate layers can enhance the properties of the PBAT as well as affecting the the morpholgy of the blend.

Melt mixing was used for compounding PBAT and PLA with Cloisite 15A and Cloisite 30B which are two organically modified silicate layers. The difference in hydrophilicity of the organic modifiers, made it possible to compare and identify the role of the clay interaction with polymers in the blend. The morphologies of the blends were examined using scanning electron microscopy (SEM) and the thermal properties of the blends were tested using differential scanning calorimetry (DSC). Finally, the mechanical properties of the PBAT were measured using dynamic mechanical thermal analyzer (DMTA). The interaction preference of the organically modified clays was systematically studied by taking the mixing orders into consideration and the morphological changes were compared among the blends in which clay was first mixed with PBAT, PLA or the blend.

The PBAT/PLA blends showed significantly higher moduli than pure PBAT samples and the blends containing clay showed improved mechanical performance compared to the similar blends without clay. X-ray powder diffraction (XRD) results indicated exfoliation and intercalation of clay particles in the blends and the SEM images showed that the presence of clay in the blends changed the morphology of the composite and the PLA-phase domain size significantly decreased. DSC results did not indicate any significant changes in the crystalization and melting temperature of the polymers.

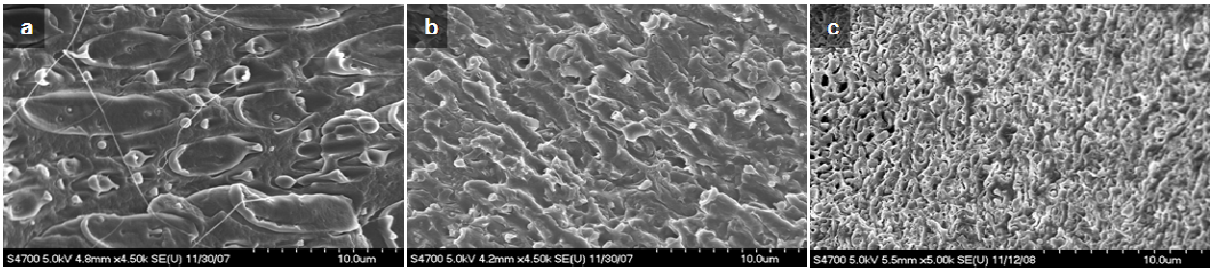


**Figure 1:** SEM micrographs of 50/50PBAT/PLA blends. (a) 50/50PBAT/PLA neat blend, (b) 50/50PBAT/PLA blend with 3% Cloisite 15A and (c) 50/50PBAT/PLA blend with 3% Cloisite 30B.

[1] Coltelli, M. B., Maggiore, I. D., Bertoldo, M., Signori, F., Bronco, S. and Ciardelli, F., Journal of Applied Polymer Science, 110 (2008) 1250-1262.