MULTILAYER PLA/TPU SHAPE MEMORY BIOCOMPOSITES

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Abstract: Due to its biodegradability and biocompatibility,poly(lactic acid) (PLA) serves in biomedical and in-vivo applications, such as bone screw, catheters, and scaffold, etc.ln many of these applications, the shape memory properties of the materials is needed. Shape memory polymer (SMP), a new class of stimuli responsive materials, has shown a fast response in changing their temporary shapes to original shapes when subjected to a certain stimulus, such as temperature, light, electric field, pH, etc. The shape memory behavior of PLA comes from the presence of crystalline and amorphous phases. Crystalline phase acts as the rigid phase that is responsible from energy storage during the temporary shape and the amorphous phase acts as the switching phase. However, the shape transition temperature of PLA is not suitable for physiological condition and its shape recovery ratio is relatively low. The blending of PLA with high molecular weight flexible polymers is a quiet simple and an economical method to optimize its properties. Thermoplastic polyurethanes (TPUs) are one of the mostly used blend components to be used in PLA based compounds since they are biocompatible, biodegradable and partially miscible with polyesters. It is well known that TPU is soft and has the ability to recover from a temporary shape to its permanent shape due to its superior entropic elasticity. It was shown in the literature that the blends of PLA/TPU system exhibited good shape memory properties than dispersed phase blends. As a special co-continuous morphology, the multilayer structure is widely existing in nature. In this study, biodegradable and biocompatible PLA/thermoplastic polyurethane (TPU) layered composite structures were prepared and their shape memory properties investigated as a function of temperature and layer structure. In addition, the mechanical, thermal and adhesion properties of layered composites were also measured.