The main drawback of polylactide – biodegradable and biocompatible polyester obtained from renewable resources, in its applications as "durable plastic" is fragility, poor mechanical and thermal resistance. In order to improve physical properties of polylactide, a number of attempts are made. A way to modify physical properties (among other numerous methods) is crosslinking of polylactide to obtain a higher strength modulus on the one hand, on the other to obtain better shape stability and greater flexibility at elevated temperature. However, the permanent crosslinking do not allow the re-processing of the material and hinders its degradability.

In the present project different methods of introducing reversible covalent bonds into PLA structure will be elaborated. It is planned to explore especially tetraphenylethylene group (TPE) which is known to undergo homolytic cleavage under mild conditions (slightly elevated temperature) generating radicals. TPE containing compounds were applied as "iniferters" for the initiation of radical polymerization of different acrylates. TPE groups were also introduced to polyurethanes to obtain their copolymers with vinyl monomers. However, the application of TPE for the modification of polylactide is not known, as well as its application for the preparation of reversible polymer networks.

It is planned to introduce TPE groups as side groups to PLA chain (by copolymerization of lactide with TPE-containing difunctional monomer) to obtain reversible polymer networks. The presence of crosslinked structure would be the main reason for changing physical properties of PLA, the ability of certain bonds to brake and re-bond would result in the further modification. The reversible nature of the bonds should facilitate processing, depending on the degree of crystallinity of the formed semi-crystalline networks, and their recycling.

The introduction of TPE moiety to the main chain of PLA (TPE group in the initiator of lactide polymerization) will enable the development of a completely new and simple method of the synthesis of PLA block copolymers with vinyl monomers (TPE in the role of iniferter). The synthesis may be performed as "one-pot" copolymerization where ring-opening polymerization of lactide and radical polymerization of vinyl monomer proceed in the same reaction medium.

The project realization will need many experiments related to the synthesis of reversible PLA networks and PLA copolymers on one hand and the extensive analysis of obtained products in respect to their composition, microstructure, morphology, physical properties (copolymers) and to thermal, mechanical, rheological properties as well as reversibility of network formation (reversible network) on the other hand.

Results obtained within the project should show new possibilities of polylactide properties modification by the introduction of reversible covalent bonds to its structure. The possibility of obtaining reversible PLA network with advantageously modified properties in comparison with not crosslinked polymer and, at the same time being reversible, should enable processing and degradation of crosslinked PLA.

Results concerning the new method of the synthesis of PLA copolymers with monomers polymerizable radically may be patented.