Abstract

In this work, new materials based on dynamic polymer networks, also called vitrimers, were developed. These polymer networks have been developed from previously unused materials based on renewable raw materials, to maximize the renewable carbon content. The main starting monomer was based on *D*-isosorbide, which is prepared from starch. The latter was modified to bis-acetoacetate and used as the main building block of the networks. Di- and tri-functional amines of various origins were used as crosslinking agents – renewable sources based and for comparison, petroleum-based products. In order to get the best possible insight into the influence of the individual monomers on the final properties of the vitrimers, materials with 1:1 and 3:1 molar ratios of di- and tri-amines were developed. The prepared networks contained vinylogous urethane-type bonds – with a very low activation energy required for transamination reactions, which allows the vitrimers to retain their mechanical properties even after multiple recycling. In the case of this work, a 10% excess of free amine groups was maintained.

The prepared materials in this thesis exhibit behaviour of vitrimers – network structure of thermosets and processability of thermoplastics. This was proven by thermal stability tests, tensile tests and tests which showed preservation of these properties even after recycling. The tests show comparable results with commercially available thermosets with the additional benefit of processability at higher temperatures.

Keywords: *thermoset, thermoplastic, reversible dynamic covalent bond, covalent adaptable network (CAN), vitrimer, renewable sources, recycling*