Prediction of the mechanical behavior of polylactic acid parts with shape memory effect fabricated by FDM

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Fused deposition (FDM) modeling is the most available, widely used method of additive manufacturing, which opens up great opportunities for manufacturing of functional components. In this report, we investigate the behavior of samples made by the FDM method from polylactic acid (PLA), of which the polymer has a shape memory effect. The dynamic behavior of FDM components along with PLA shape memory is of great interest in their design and manufacture for possible applications. This report shows methodology for describing thermomechanical properties is considered, combining the characteristics of a thermoplastic material with the shape memory effect and FDM printing parameters. The results of the Uniaxial tensile experiment allow us to evaluate the effect of printing parameters on strength characteristics. The viscoelastic behavior of the material was considered, which is determined by the dependence of temperature during time. The viscoelasticity characteristics of the polymer are determined by dynamic mechanical analysis. To study the shape memory of samples with different printing parameters, a thermocyclic tensile tests were performed. The shape fixity and recovery of samples after application of loads, as well as the dynamic response of parts printed on an FDM 3D printer, depend on the viscoelastic characteristics of polymer fibers and printing modes.

The report summarizes to collect experimental, and simulation mechanical data of samples produced with different parameters by the FDM method to build a complete the picture of the mechanical and thermomechanical behavior, considering the viscoelastic properties of samples with a shape memory effect from polylactic acid.

Keywords: shape memory polymers (SMP), FDM, PLA, viscoelastisity