

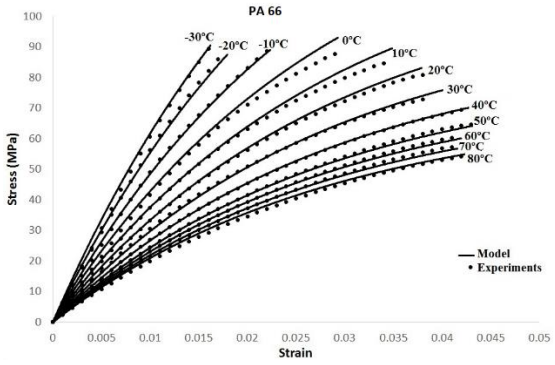
A unified expression to estimate the stress-strain curve of polyamides at different temperatures

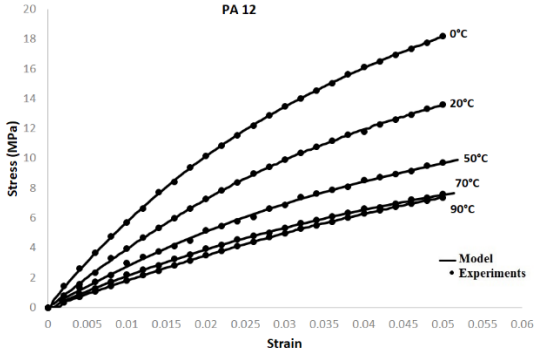
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Abstract

The present paper proposes a unified expression to estimate the mechanical behaviour of polyamides in tensile tests at different temperatures. The goal is to present an algebraic equation able to describe the stress-strain curves that would be obtained using the ASTM D638-14 standard for a wide range of temperatures (roughly from -30 °C to 90 °C, even above the Glass Transition Temperature). This expression is valid for different kinds of polyamides. It is shown that with a minimum of three tests performed at different temperatures, it is possible to obtain a reasonable approximation of the stress-strain curve for this range of temperatures. Examples are presented considering different types of polyamides – PA11, PA12 and PA66-GF30 (PA66 reinforced with 30 wt% of short glass fibres). Although the mechanical behaviour is strongly affected by temperature variation, the estimates of the material behaviour are in good agreement with experiments in all cases studied in this paper. Such a procedure can be a practical tool for designers, used to obtain a reasonable approximation of tensile tests and thus reducing the need of performing many complex experiments.

Key words: Polyamides; Tensile tests; Temperature; Mechanical behaviour; Modelling





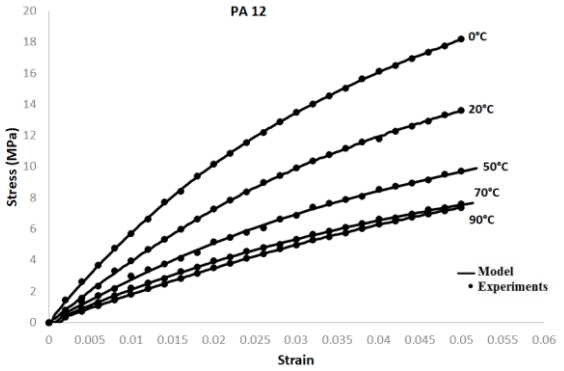


Figure 1 – PA66-GF30, PA12 and PA 11 experimental and theoretical stress - strain curves for different temperatures.

Recent Publications

1. da Costa Mattos HS, JML, T. de Sant´anna, Coutinho PP, MonteiroAH, Teixeira SCS, Chaves EG (2016) Coupled effect of ageing and temperature in the mechanical behaviour of a polyamide. Polym. Test. 53:267-275.
2. da Costa Mattos HS, Reis JML, de Medeiros LGMO, Monteiro AH, Teixeira SCS, Chaves EG, Analysis of the cyclic tensile behavior of an elasto-viscoplastic polyamide, Polym. Test. 58 (2017) 40-47.
3. Reis JML, Amorim FC, da Silva AHMFT, da Costa Mattos HS (2015) Influence of temperature on the behavior of DGEBA (Bisphenol A diglycidyl ether) epoxy Adhesive. Int. J. Adhes. Adhes 58:88-92.
4. Reis JML, Pacheco LJ, da Costa Mattos HS (2014) Temperature and variable strain rate sensitivity in recycled HDPE. Polym. Test. 39:30-35.
5. Reis JML, Pacheco LJ, da Costa Mattos HS (2013), Influence of the temperature and strain rate on the tensile behavior of post-consumer recycled high-density polyethylene, Polym. Test. 32:1576-1581

Biography

Professor Heraldo da Costa Mattos has a Mechanical Engineering degree (1982), a M.Sc. in Mechanical Engineering (1984) and Ph.D. in Mechanical Engineering (1988) received from the Catholic University of Rio de Janeiro, Rio de Janeiro, Brazil. Since 1994 he is Full Professor of Mechanical Engineering at the Fluminense Federal University, Niterói, Brazil. His main interests in research and teaching are in the area of Mechanical Engineering, with emphasis on Solid Mechanics, acting mainly in the following fields: (i) Inelastic behaviour of solids – elasto-plasticity, elasto-viscoplasticity, viscoelasticity; (ii) Damage Mechanics, Fatigue Mechanics and Fracture Mechanics; (iii) Thermodynamics of inelastic materials.

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