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Constitutive modelling of polycarbonate at low, moderate, and high strain rates

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ABSTRACT

The objective of this paper is to experimentally investigate and predict the mechanical behavior of polycarbonate at strain rates ranging from 10^{-4} to 5000 s^{-1}. Compression tests at low, moderate, and high strain rates were conducted with a Shimadzu universal testing machine, a Gleeble 3500 thermo-mechanical simulator, and a split Hopkinson pressure bar, respectively. Considering the effects of the glass (α) transition and the second (β) transition on the mechanical behavior of polycarbonate, a new constitutive model is proposed, which is decomposed into the α and β components. The α component dominates the low and moderate rate deformations, and the β component is related to the high rate deformation. In comparison with the experimental results, the model can accurately predict the mechanical behavior of polycarbonate at low, moderate, and high strain rates.

KEYWORDS: polycarbonate, constitutive model, mechanical behavior