

Hardening Curves of Polycarbonate at Quasistatic-to-High Strain Rates

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Abstract

The polycarbonate exhibits a very special deformation mode in tensile tests, as the plastic strain firstly flows uniformly, then localizes at a neck section, then propagates all along the specimen until the necking vanishes, and finally flows again uniformly until failure.

This feature poses significant challenges in the characterization of the hardening of polycarbonate, as different experimental measurements of stress and strain are possible on the same specimen, leading to different resulting curves subjected to different undesired disturbances from the surrounding environment.

This paper firstly analyzes three possible strategies for the experimental derivation of the true stress - true strain curves, identifying the one less prone to external spoiling effects. Then it also proposes a corrective function to transform such “true curve” into an estimate of the effective flow curve, by accounting for the stress triaxiality induced by the necking and by the peculiar propagative straining mode of polycarbonate.

A set of True curves and corrected Flow curves is then derived at different strain rates including quasistatic, low, medium and high rates, referring to data from a dedicated experimental campaign and from the literature.

Finite elements simulations of the experimental tests are also provided in this work, confirming the suitability of the proposed procedure to derive the static and dynamic hardening curves of polycarbonate.

Keywords: Polycarbonate; Necking; Flow stress, True stress, Hardening,

References

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