21 Sep
01:30am

Testing and identification of the LLDPE material for impact applications.

Jan Špička
University of West Bohemia

Current industrial trends bring new challenges in energy absorbing systems. Polymer materials as the traditional packaging materials seem to be promising due to their low weight, structure, and production price. Based on the review, the linear low-density polyethylene (LLDPE) material was identified as the most promising material for absorbing impact energy. The current paper addresses the identification of the material parameters and the development of a constitutive material model to be used in future designs by virtual prototyping. The paper deals with the experimental measurement of the stress-strain relations of linear low-density polyethylene under static and dynamic loading. The quasi-static measurement was realized in two perpendicular principal directions and was supplemented by a test measurement in the 45◦ direction, i.e., exactly between the principal directions. The quasi-static stress-strain curves were analyzed as an initial step for dynamic strain rate-dependent material behavior. The dynamic response was tested in a drop tower using a spherical impactor hitting a flat material multi-layered specimen at two different energy levels. The strain rate-dependent material model was identified by optimizing the static material response obtained in the dynamic experiments. The material model was validated by the virtual reconstruction of the experiments and by comparing the numerical results to the experimental ones.