DYNAMIC FRACTURE PROPERTY OF PLASTICALLY COMPRESSED AND AGED POLYCARBONATE

Zheng Li[a], Guiyun Gao[a], Mehrdad Negahban[b]

[a] LTCS, College of Engineering, Peking University, Beijing 100871, PR China, lizheng@pku.edu.cn
[b]Mechanical & Materials Engineering, University of Nebraska-Lincoln, Lincoln, NE68588, USA, mnegahban@unl.edu

ABSTRACT

Polycarbonate (PC) is widely applied in industry as a useful engineering material, because it has high strength and toughness as well as good transparency. Aging and plastic compression are known to change the properties of PC dramatically, especially the dynamic fracture properties. Here we studied the combined effects of large plastic flow and thermal aging on dynamic fracture properties of PC by the optical experimental method, caustic method. First the anisotropic properties of PC with large plastic strain were characterized by ultrasonic method. Then the initial curve and caustic curve of caustics in orthotropic case were deduced, and the stress intensity factor could be derived. Furthermore, dynamic fractures of PC were also conducted by three point bending beam with a falling weight. The samples were prepared with different extents of plastic compressive strain up to approximately 50% engineering strain, followed by aging with various aging times up to 700 hours. The fracture processes were recorded by a high speed camera. Finally, the fracture mechanisms of PC with plastic compression and aging were analyzed combined with surface observation by SEM. Results show that the specimens with different compression orientations have different fracture toughness and quite different fracture modes. Aging affects the fracture properties in uncompressed and compressed specimens in similar trend. Under large plastic compressive strain, PC becomes more fracture resistance and anisotropy, which has a great potential for material deign.

Acknowledgement: This research work was supported by National Basic Research Program of China (973 Program) under Grant No. 2010CB731503.