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The dynamic mechanical properties of magnetorheological plastomers under high strain rate

Jiaqi Xu[1], Pengfei Wang[1], Haoming Pang[1], Yunpeng Wang[1], Jie Wu[1], Shouhu Xuan[1], Xinglong Gong[1]*

[1]*CAS Key Laboratory of Mechanical Behavior and Design of Materials, Department of Modern Mechanics, University of Science and Technology of China, Hefei 230027, China*

Email: gongxl@ustc.edu.cn

Abstract

The dynamic mechanical properties of magnetorheological plastomers (MRPs) were investigated by using a Split Hopkinson Pressure Bar (SHPB) equipped with an electromagnetic accessory. Both the SHPB and rheological test indicated the mechanical properties of MRPs increased with strain rate, which demonstrated the typical rate dependent stiffening performance. With strain rate increased from 1580 s^{-1} to 7900 s^{-1}, the maximum stress of MRPs increased from 31MPa to 66MPa. MRPs also exhibited a magnetic strengthening behavior due to the MR effect. Keeping the strain rate at 6500 s^{-1}, the maximum stress increased 19.8 MPa as the magnetic flux density increased from 0 to 480 mT and the increase rate of maximum stress reached to 34%. Moreover, a high-speed camera was also used to capture the deformation of MRPs in both low and high strain rates. Based on the above results, a possible mechanism was proposed to investigate the dynamic mechanical properties of the MRPs. The synergistic effect between the magnetic field dependent particle structure