Anisotropy in fracture toughness of shale and coal under dynamic loading

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Abstract

Notched semi-circular bend (NSCB) samples are prepared with different bedding angles and subjected to dynamic loading by a modified split Hopkinson pressure bar (SHPB) system. The static fracture toughness (SFT) of shale or coal increases linearly with the bedding angle. Under similar loading rates, the dynamic fracture toughness (DFT) of shale increases as the bedding angle rises. However, the DFT of coal is much discrete. The DFT of shale or coal increases with loading rate increasing. DFT is much higher than SFT. For shale, there is almost a linearly positive correlation between DFT and loading rate, while for coal, there is a logarithmic relationship. All values of coal are much smaller than that of shale. As the loading rate increases, the effect of bedding angle on DFT attennuates. Notably, for bedding angle of 45°, the cracking mode of coal is more easily affected by bedding plane, than for other angles.

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