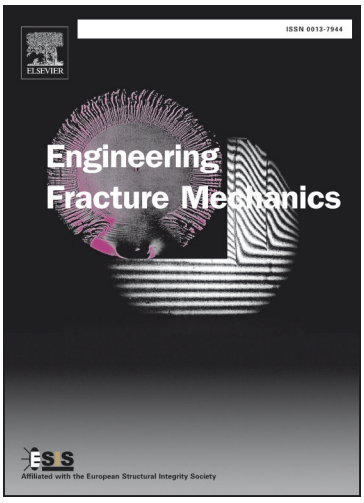

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Study of the dynamic fracture characteristics of coal with a bedding structure based on the NSCB impact test

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Abstract: To study the dynamic fracture deformation and failure characteristics of coal samples, the split Hopkinson bar (SHPB) impact loading system is used to test the dynamic fracture toughness of coal samples based on the notched semi-circular bend (NSCB) method under an impact load. The influence of the impact velocity and bedding angle on the dynamic fracture toughness, failure strain and strain rate of coal samples is preliminarily discussed, and a high-speed camera records and observes the dynamic fracture process of the coal sample. Finally, the distinct lattice spring model (DLSM) numerical analysis method is applied to analyze the sample dynamic splitting process and the change in the stress field. Meanwhile, the influences of the impact velocity, bedding angle, elastic modulus of bedding medium, bedding spacing and bedding width on the K_{IC} test results are quantitatively analyzed.

Keywords: dynamic fracture toughness; coal-rock; bedding; DLSM

1. Introduction

Rock coal, a sedimentary nonuniform rock, was formed as minerals from sedimentary rock broke down and evolved from ancient surface humus together with the influence of the palaeoclimate and sedimentary environments. There is a large number of weak structural planes, such as joints and bedding, that contribute to the complicated physical and mechanical properties of coal-rock [1]. With respect to coal mining, engineering stability control, engineering parameters selection, rock burst disaster prevention and control, and so on, the dynamic fracture of coal-rock is more obvious than other damage [2-3]. Thus, it must be determined whether such an imbalance will impact the mechanical properties of coal-rocks in different bedding directions. Using various large coal sample uniaxial compression tests, T. P. Medhurst and E. T. Brown [3] found that the peak strength of a dim coal sample was larger than that of a bright coal sample of the same size. Furthermore, a study on the tensile strength test of coal-rock by Wu Jiwen and Yan Lihong [4] found that the tensile strength of coal-rocks was different with bedding directions which was the evidence of anisotropy due to the bedding direction effects on the mechanical properties of coal. As a result of explosions and other severe dynamic loads, coal-rocks are part of a complex stress environment where they are subjected to different stress states, such as

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