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脆性材料强破裂前兆的初步研究

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A preliminary study on precursors of strong fracture in brittle material specimens

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摘要 本文依据现有的实验结果初步研究脆性材料在破坏孕育过程中发生的强破裂的前兆特征.以应变(形变)突变、破裂弹性波限幅等物理变化特征确定强破裂;研究总结了不同试样、两种加载方式的破坏试验中的多个强破裂的前兆特征变化:一类为包括定点和场的应变变化特征,另一类为包括声发射率(破裂频度)、*b*值、波谱及微破裂时空分布等的声发射变化.此外,还有突发电磁扰动和应变扰动.然而,所有这些前兆特征变化并非在所有材料试样、所有强破裂之前同时都出现,也不是所有测点、任何方位都能观测到.同时指出,至今未见到对一次破坏实验中的系列强破裂(至少3~5个)前兆特征的系统对比研究,这正显示了这类研究的艰难,深入开展强破裂前兆研究对地震预测可能有重要意义.

关键词: 强破裂 应变 声发射 微破裂 前兆变化

Abstract: This paper conducts a preliminary study on the characteristic precursors of strong fractures occurred in the process before failure of brittle material specimens based on experimental results. First, strong fracture is defined by sudden variation of strain at some points and limited amplitude of wave recorded at some stations, and then the precursory characteristics are summarized before several strong fractures for various samples during two ways of loading, one kind of precursors is related to strain variation at specific points and the character of strain field, and another is the variation of acoustic emission features including AEs rate, *b*-value, spectrum and the variation of distribution of microcracks with time and space. In addition there are sudden strain and electromagnetic disturbances. However these precursors do not necessarily all emerge or at the same time, and nor they could be observed at all points and in any direction before a strong fracture for various samples of different materials. It should also be pointed out that there are no systematic studies on the precursors of many strong fractures in the process before failure. These show the difficulties of studying the precursor of fracture. Nevertheless it could be more meaningful for earthquake prediction. We appeal to further study the precursor characteristics of strong fractures.

Keywords: Strong fracture Strain Acoustic emission Microcrack Precursor variation

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