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冲击载作用下岩石变形破坏的细观结构特性

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摘要　研究细观结构水平上黏性随着应变率增加而减小的机制。由分析可以看出，在细观水平上黏性随着应变率增加而减小与介质变形的转动模式有关。在一定的冲击波波阵面宽度及晶粒大小条件下，介质粒子会产生转动。在细观水平上当动量矩守恒近似满足时，最可能的情况是相邻2个介质粒子做相向运动，形成共轭对。随着应变率的增加，越来越多的粒子形成共轭对。共轭对粒子间的相对运动减小，因而黏性减小。总之，黏性随着应变率的增加而减小的机制在于介质内部的自由度被冲击载激起，并产生细观粒子的相关联运动。

关键词　岩石力学；结构层次；动力变形与破坏；细观结构；旋转运动；共轭对

分类号

MESOSTRUCTURAL ASPECTS OF DEFORMATION AND FRACTURE OF ROCK UNDER SHOCK LOADING

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Abstract

The strength of rock is related with its viscosity under shock loading. Experimental results show that viscosity of rock at mesolevel is inversely proportional to strain rate under shock loading. The mesostructural aspects of mechanism of decrease of viscosity with growth of strain rate are investigated. It is shown that mesolevel decrease of viscosity with growth of strain rate is related with rotational mode of motion of particles of materials. When the width of shock wave front and size of particles of medium satisfy certain conditions，rotational mode of motion of particles will take place. When the conservation law of moment of momentum is satisfied approximately at mesolevel，the most possible variant is that two neighboring particles rotate oppositely and form conjugate pairs. The two particles of conjugate pairs rotate in opposite direction. With the growth of strain rate，more and more conjugate pairs will appear. The velocity of relative motion between the particles of conjugate pairs is low，and consequently the viscosity is low. In a word，the decrease of viscosity with growth of strain rate lies in activation of internal degrees of freedoms and the emergence of correlated motion of particles of materials under strong dynamic loading.

Key words rock mechanics；structural hierarchy；dynamic deformation and fracture；mesostructure；rotational mode of

motion；conjugate pairs

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