

饱水岩样声波传播规律的试验研究

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摘要 先将板岩、花岗片麻岩、黑云母片麻岩3种岩样烘干后在3个方向进行声波试验, 然后将上述岩样在饱水条件下进行同样测试, 通过纵横波透射测试得到岩石内部结构的一些信息, 从而对3种岩样的饱水和烘干条件下声波传播规律进行研究。通过对岩石岩样声波波形、波幅衰减规律和波谱特征分析发现: (1) 3种岩样吸水率均较低, 平均饱和吸水率一般为0.100%~0.212%, 其纵横波波速受水的影响较小。(2) 3种岩样饱水后纵波的衰减速率大大降低, 而横波饱的衰减速率明显增强, 饱水对纵横波衰减速率的影响趋势截然相反。(3) 板岩和黑云母片麻岩的声波衰减各向异性特征明显; 而花岗片麻岩声波衰减各向异性特征不明显; 3种岩样的声波衰减各向异性特征差异很大, 岩样种类不同, 则饱水对声波衰减速率的影响也完全不同。(4) 3种岩样饱水状态下纵横波主频明显比烘干状态下要降低许多; 对声波信号3层db1小波包分解后发现, 3种岩样饱水后最低频率范围内纵波信号能量所占比例增加, 较高频率段纵波信号能量所占比例降低。

关键词 [岩石力学](#); [声波](#); [频谱](#); [小波包分析](#)

分类号

EXPERIMENTAL STUDY ON ACOUSTIC WAVE PROPAGATION CHARACTER OF WATER SATURATED ROCK SAMPLES

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Abstract

Rock samples including slate, biotite gneiss and granite gneiss are desiccated in the condition of 100°C–110°C and tested by ultrasonic method. These samples are saturated in the vacuum container for 24 hours, and then tested by ultrasonic method again. Based on the synthetic analysis of acoustic wave, wave attenuation and frequency spectrum characters, some conclusions are drawn. The water content percentage in rock samples is 0.100%–0.212%. The velocities of P-wave and S-wave in rock samples are scarcely varied under water-saturated and dry conditions. The P-wave attenuation decreases when dry samples are water-saturated, on the contrary, the S-wave attenuation increases in the same case. Different rocks appear different attenuation anisotropy characters; and the wave attenuation anisotropy in slate and biotite gneiss is observed under dry and water-saturation conditions. However, such phenomenon has seldom been found in granite gneiss. The wave base frequency gets lower when rock samples are water-saturated. The waves are decomposed by db1 wavelet packet at the third level and the energy of different frequency area is calculated. It is found that, when dry rocks are water-saturated, the P-wave energy proportion of the lowest frequency part increases; but the energy proportion in higher frequency part decreases.

Key words [rock mechanics](#); [acoustic wave](#); [frequency spectrum](#); [wavelet packet analysis](#)

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