Acoustic

1- H-shaped acoustic micro-resonator-based quartz-enhanced photoacoustic spectroscopy

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Abstract:
An H-shaped acoustic micro-resonator (AmR)-based quartz-enhanced photoacoustic spectroscopy (QEPAS) sensor is demonstrated for the first time. The H-shaped AmR has the advantages of easy optical alignment, high utilization of laser energy, and reduction in optical noise. The parameter of the H-shaped AmR is designed based on the standing wave enhancement characteristic. The performance of the Hshaped AmR-based QEPAS sensor system and bare quartz tuning fork (QTF)-based sensor system are measured under the same conditions by choosing water vapor (H2O) as the target gas. Compared with the QEAPS sensor based on a bare QTF, the detection sensitivity of the optimal H-shaped AmR-based QEPAS sensor exhibits a 17.2 times enhancement. (C) 2022 Optica Publishing Group

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2- Experimental study on acoustic emission (AE) characteristics and crack classification during rock fracture in several basic lab tests

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Abstract:
A series of rock tests including Brazilian indirect tension test (BITT), three-point bending test (TPBT), modified shear test (MST) and uniaxial compression test (UCT) were conducted to investigate the acoustic emission (AE) characteristics and crack classification during rock fracture. The test results show that the rock fracture process presents an obvious segmented variation feature and has a dramatic increasing period, according to the change trends of AE hits and AE energy characteristic parameters. The AE characteristics are closely related to the types of micro-cracks produced in the rock fracture process. The elastic strain energy released by shear crack is greater than that released by tensile crack. Most of AE

signals generated in compression and shear failures that mainly produce shear cracks have low average frequency (AF) values and low peak frequencies (below 100 kHz). On the contrary, most of AE signals generated in bending and tensile failures that mainly produce tensile cracks have low RA (ratio of rise time to amplitude) and high peak frequencies (above 100 kHz). In addition, the dividing lines were defined to distinguish the tensile cracks and shear cracks in the AF-RA scatter plots for different rocks. For instance, the AE signals above dividing line accounted for more than 62%, which indicated that the tensile cracks were dominant in TPBT. However, the AE signals below dividing line accounted for more than 74%, and the shear cracks were dominant in UCT. Therefore, the AE characteristics can be used to determine the fracture modes of rock, then to shed light on the micro-crack properties.