



Recent experimental researches of thermal infrared imaging applied in rock and mining engineering

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The application of thermal infrared (TIR) radiation imaging technology in rock and mining engineering is developed rapidly in recent 10 years. The recent experimental studies are presented. The experimental methods, instruments, and some typical results concerning the TIR radiation characteristic during the progressive damage process are introduced. The studies include TIR imaging of rock failure, TIR imaging of concrete failure, TIR imaging of interaction between bolt and rock, TIR imaging of roadway deformation, and TIR imaging of ultra-high molecular weight polyethylene (UHMWPE) fracturing. It is discovered from the experiment study that the temporal sequential features of the TIR radiation in the process of loading are controlled by mechanical behaviors, and they show different staged characteristics. According to the change ratios of TIR radiation temperature of the different areas of the bolted rock samples, the bolted range with the single bolt and two bolts are determined. The bolted ranges are accordant with the results of numerical simulation with ANSYS. According to the change ratios of TIR radiation temperature of the different areas of the coal roadway, the zones of action of several bolts in the wall rocks are determined. The bolted ranges are the same as the results of numerical simulation with FLAC3D. The places of TIR omen of rock specimens, concrete specimens, bolted rocks and tunnel wall rocks have been determined based on the changes of the TIR radiation energy. The relationships of UHMWPE were analyzed between average infrared temperature (AIRT) and strain, and AIRT and mechanical work. The mechanism of rock's TIR radiation changes during the damage process has been discussed. The creative method

will be applied in the fields of mining engineering, underground engineering and side slope engineering.