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岩石撞击的热红外成像探测研究进展与方向

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摘要 岩石撞击的热红外成像探测是遥感技术的一项新颖而颇具潜力的应用, 亦是遥感-岩石力学交叉学科的重要研究内容。分析岩石撞击热红外成像探测的试验技术原理与特点, 介绍前期试验探索成果及新近研究进展。主要包括: 热红外技术用于固体撞击瞬态过程监测的试验探索、Hopkinson压杆撞击(包括不同角度、含水岩石靶元的撞击)、岩石与岩石之间的撞击、不同类型岩石的落球撞击、基于红外辐射特征的撞击参数反演研究以及矿山诱灾分析的应用基础研究。讨论岩石撞击辐射升温的物理机制, 包括岩石破裂作用机制、岩石热弹效应以及岩石物理学机制。指出岩石撞击热红外成像探测的未来发展方向为辐射规律与物理机制、定量分析与遥感模型、谱段优选与实用技术。

关键词 [岩石力学](#) [岩石撞击](#) [遥感-岩石力学](#) [遥感应用](#) [热红外成像](#) [反演](#)

分类号

RESEARCH PROGRESSES AND DIRECTIONS OF DETECTION ON ROCK IMPACTION WITH THERMAL INFRARED IMAGING

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Abstract

Detection on rock impaction with thermal infrared(TIR) imaging is not only a creative and prospective application of remote sensing technology, but also one of the important contents of the new inter-discipline called remote sensing rock mechanics(RSRM). The experimental technology of TIR imaging on rock impaction is analyzed; and the experimental exploration results at the early stage as well as recent research achievements are introduced. The main experiments conducted include the experimental exploratory to TIR imaging for detecting the transient process of solid impact, projectile impaction on rock by a Hopkinson compression bar(at different impacting angle or with water in rock body), free-fall impaction between rocks, free-ball impaction on different types of rocks. Based on the results from the above experiments, two kinds of application foundations are researched, i.e. the back analysis of the impact-related quantities of rock impaction and the analysis of the possibilities for the disasters induced by rock impaction in mining area. It is shown that (1) the impact-related quantities can be back analyzed quantitatively/qualitatively by the TIR detection; for example, the impacting velocity or impacting energy can be back analyzed quantitatively; and the accuracy of the back analysis lies on the homogeneity of rocks, and the errors of back analysis based on the impaction on homogeneous marble are less than 12%; and (2) the increment of temperature due to rock impaction could probably ignite the gas in coal mine, therefore, it can be helpful to the analysis or the remote detecting/forecasting of disasters that may be induced by rock impaction. The mechanisms of the TIR radiation temperature variation due to rock impaction are discussed, including the rock fracturing, rock thermo-elastic effect and rock physics. It is pointed out that the future research directions include the radiation laws and physical mechanism, the quantitative analysis and remote sensing model, and the spectrum optimization and practical technology.

Key words [rock mechanics](#) [rock impaction](#) [remote sensing rock mechanics\(RSRM\)](#) [application of remote sensing](#) [thermal infrared\(TIR\) imaging](#) [inversion](#)

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