

Optimal irradiation patterns and spacings for microwave fracturing diorite

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Abstract: Microwave heating has been considered as a promising method for rock breaking in the mining and tunneling engineering. Previous studies have primarily focused on the response characteristics of specimens subjected to single-point microwave irradiation. However, the response characteristics of rocks after multi-point microwave irradiation and the optimal irradiation patterns and spacings have not yet been systematically studied. In this study, microwave surface irradiation tests were conducted using a dielectric-loaded converging waveguide antenna with different irradiation spacings (10 cm, 15 cm, and 20 cm) and patterns (triangular and rectangular). The interactions between the cracks induced by microwave irradiation were investigated, and the damage zone induced by microwave were analyzed. The results indicate that the optimal microwave rock-breaking effect is achieved when radiation points are arranged in a triangular pattern with a spacing of 15 cm. This finding provides a fundamental basis for designing irradiation patterns for the commercial application of this technique in the field.

Keywords: Microwave treatment, Optimal irradiation spacing, Fracture patterns, damage zone.