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Experimental study on mechanical properties of diabase fracture-grouting mass

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ABSTRACT

To analyze the influence of fracture geometry on the weakening of rock mass mechanical properties after grouting, a different crack inclination angle, crack penetration degree and number of cracks were prefabricated by cutting diabase. A simple grouting mold for fractured rock samples was designed and applied for an indoor grouting test. Uniaxial and conventional triaxial compression tests of the diabase and its fracture-grouting mass and the indoor grouting test of the fractured rock samples were conducted. The stress-strain relationship and mechanical properties of the diabase fracture-grouting mass under different fracture geometries were comprehensively analyzed. The primary conclusions are as follows：(1) Filling cement slurry in the fracture and confining pressure significantly changes the rock sample stress-strain relationship, from the typical brittleness of the original rock to the elastic-within a certain range plastic-brittle or ideal elastoplasticity. In addition to slippage occurrence along the fracture surface, the ductility of the post-peak zone was significantly improved; (2) The fracture significantly reduces the mechanical properties of the rock sample and the fracture-grouting mass exhibits obvious anisotropy. The mechanical properties perform worst at low confining pressure, full penetration, and a 60° crack inclination angle in the most unfavorable state; (3) The strength and deformation parameters of the diabase fracture grouting body are closely related to its fracture number, dip angle, penetration degree, and grouting filling and confining pressure. It further reveals that when the confining pressure of the surrounding rock decreases after tunnel excavation and the degree of rock mass fragmentation (fracture penetration, dip angle increases, number of fractures increases), the grouting rock mass continues to show low mechanical parameters and remains discrete after grouting reinforcement owing to the complex structure of rock mass in tunnel engineering. This result provides guidance for the design and construction of fractured rock tunnel engineering, and has clear theoretical value and practical significance.

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