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Displacement velocity effects on rock fracture shear strengths

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ABSTRACT

Triaxial shear tests are performed to assess the effects of displacement velocity and confining pressure on shear strengths and dilations of tension-induced fractures and smooth saw-cut surfaces prepared in granite, sandstone and marl specimens. A polyaxial load frame is used to apply confining pressures between 1 and 18 MPa with displacement velocities ranging from 1.15×10^{-5} to 1.15×10^{-2} mm/s. The results indicate that the shearing resistances of smooth saw-cut surfaces tend to be independent of the displacement velocity and confining pressure. Under each confinement the peak and residual shear strengths and dilation rates of rough fractures increase with displacement velocities. The sheared-off areas increase when the confining pressure increases, and the displacement rate decreases. The velocity-dependent shear strengths tend to act more under high confining pressures for the rough fractures in strong rock (granite) than for the smoother fractures in weaker rocks (sandstone and marl). An empirical criterion that explicitly incorporates the effects of shear velocity is proposed to describe the peak and residual shear strengths. The criterion fits well to the test results for the three tested rocks.