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Permeability evolution of thermo-mechanically coupled granite

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Permeability of Luhui granite with 200mm in diameter and 400mm long was measured at triaxial stresses and elevated temperature using 600°C/20MN servo-controlled triaxial rock mechanics testing machine. It is found that 300°C is the threshold temperature (T_c) of permeability change with temperature in thermally cracked granite. The magnitude of permeability is 10^{-7} D with a low increase below T_c and the permeability whose magnitude is 10^{-6} D increases drastically with high amplitude at 300°C-400°C while the magnitude is 10^{-5} D at 400°C. Simultaneously, the change of micro-crack quantity in thermally cracked Luhui granite at temperature up to 400°C was quantitatively investigated by MPV micro-photometer. Two peaks of micro-crack quantity that the length is more than 5 μ m and 10 μ m respectively exist at temperature up to 400°C. The temperature scope where micro-crack quantity peak appears in length>5 μ m is less than that in length>10 μ m. The quantity of micro-crack whose length is more than 10 μ m increases sharply at the rate of one per ten centigrade at temperature above 300°C. The drastic increase of micro crack above 300°C is the main reason that permeability increases sharply at temperature above 300°C in thermally cracked granite. Compared with preheated results, thermal and mechanical coupled effect can more heavily affect granite permeability than only thermal effect.

References

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