HEALING OF FRACTURES IN ROCK SALT

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Abstract

Healing effectiveness of rock salt fractures as affected by the applied stresses, fracture characteristics, moisture content and time was investigated in the laboratory. The effort involved (1) fracture pressurization tests under uniaxial and radial loading, (2) gas flow permeability tests to monitor the time-dependent behavior of the salt fractures, and (3) point loading and diameter loading tests to assess the mechanical performance of the fractures after healing. Tension-induced fractures and fractures formed by saw-cut surfaces and by polished surfaces were prepared in salt specimens. Series of gas flow testing were performed to monitor the changes of the fracture permeability under quasi-static loading ranging from 0.7 to 20 MPa for up to 120 h. Healing tests under static loading are were carried out under both dry and saturated conditions. The results suggest that the primary factors governing the healing of salt fractures are the origin and purity of the fractures, and the magnitude and duration of the fracture pressurization. Inclusions or impurities significantly reduce the healing effectiveness. The hydraulic conductivity of the fractures in pure salt can be reduced permanently by more than 4 orders of magnitude under the applied stress of 20 MPa for a relatively short period. For most cases the reduction of salt fracture permeability is due to the fracture closure which does not always lead to fracture healing. The closure involves visco-plastic deformation of the asperities on both sides of the salt fracture, while the healing is related to the covalent bonding between the two surfaces. Fracture roughness and brine saturation apparently have an insignificant impact on the healing process.

Keywords: Healing, rock salt, fracture, permeability