Definition of the Dilatancy Boundary Based on Hydro-Mechanical Experiments and Acoustic Detection

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Abstract

The Dilatancy Boundary is defined for Asse Rock Salt based on triaxial compression experiments conducted under determined stress, stress-build up rate and pore pressure conditions. The pore volume changes due to deviatoric stresses are measured with the aid of a high precision piston pump. The dilatancy boundary is thus determined based on the minimum pore volume separating the compressive and dilatancy regions during a compression test. In a certain number of the experiments, the acoustic emissions due to crack development were recorded with 10 sensors mounted on the walls of the salt cores. The spontaneous increase of the cumulative number of the acoustic events was identified to be consistent with the dilatancy boundary based on pore volume variations. A dependency of the dilatancy boundary on the stress rate as well as on the pore pressure was confirmed. The dilatancy boundary, marked by the deviatoric stress and axial strain is found to decrease with increasing stress rate, the effect being greater with increasing minor normal stresses. High pore pressure is found to accelerate the dilatancy as well as the permeability increase. The effective stress concept is applied for the definition of the dilatancy boundary and the Biot coefficent is matched with 0,1 for Asse rocksalt.