where $d\varepsilon_v$ is the dilatant strain due to the influence of τ, dP is the difference in pressure between actual and that where, for the value of τ, $d\varepsilon_v$ would be zero, and x and A are constants in τ. The complete constitutive relationship thus has the form

$$\varepsilon_{total} = -\frac{dP}{K(P)} + d\varepsilon_v \quad , \tag{2}$$

where ε_{total} is the total volume strain, K is the bulk modulus, and $d\varepsilon_v$ is from Eq. (1).

SCHOCK, R. N., Abey, A. E., and Duba, A., Quasi-static deformation of porous beryllium and aluminum, Lawrence Livermore Laboratory, Rept. UCRL-76587, Preprint (1975).

Loading and unloading of two types of porous beryllium and a porous aluminum under conditions of uniaxial strain, proportional loading, and hydrostatic pressure indicate that yielding is dominated by porosity. Analysis of the data prior to yielding indicates that aspherical pores cause increased compressibility on initial loading. All materials exhibit enhanced compaction when loaded under nonhydrostatic stress conditions. Models which treat the collapse of spherical pores do not agree with the beryllium data, probably because of the influence of aspherical pores and pore-size distribution.

SCHOCK, R. N., A constitutive relation describing dilatant behavior in Climax stock granodiorite, Int. J. Rock Mech. Mining Sci. 13, 221-23 (1975). [UCRL-77204, Preprint]

Climax stock granodiorite was compressively loaded along different paths to failure at a fixed strain rate and at mean pressures to 0.7 GPa. These data are used to develop a constitutive relationship. The expression relates dilatant volume strain ε_d to mean pressure P and shear stress τ in the form

$$\varepsilon_d = \exp\left[\frac{\delta P}{x(\tau)} - A(\tau)\right] \quad ,$$

where x and A are explicit functions of τ. The equation has the advantages of simplicity and expression of the actual behavior in terms of measured physical parameters.

SHOCK, R. N., Constitutive relation for a granodiorite in compression, Eos Trans. AGU 56, 441 (1974). [UCRL-77610, Abstract]

Principal stress and principal strain data measured during compression of Climax stock granodiorite over a variety of shear stress-mean pressure loading