Experimental data for the comparative energetics of other deformation types with simple shear

Plastic field: in my paper "Approach to deformation theory based on thermodynamic principles" I quoted Franssen & Spiers, Deformation of polycrystalline salt in compression and in shear at 250-350℃. In: Deformation mechanisms, rheology and tectonics. Knipe & Rutter (eds), Geol Soc Spec Publ 54, 201-212.
I scanned these figures from Franssen's thesis (Utrecht 1993), Chapter 4, which is identical to the quoted paper:

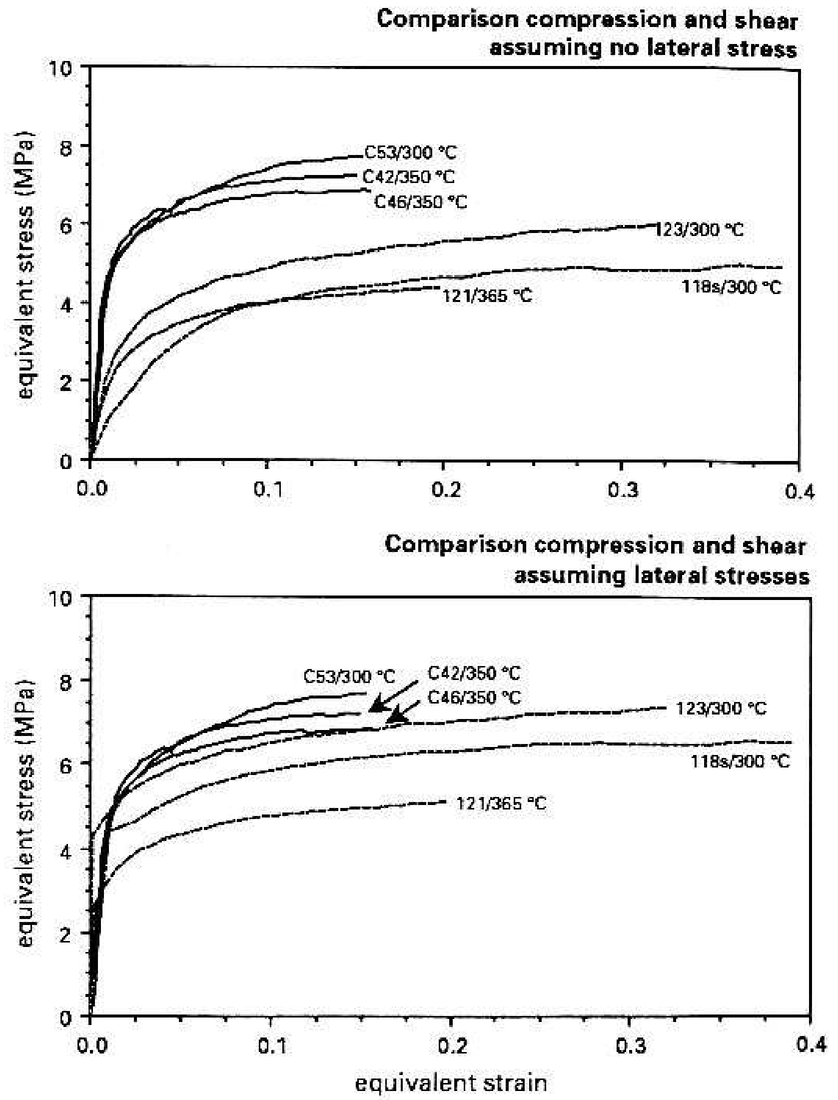

Figure 4.12:
Comparison of mechanical data from the compression tests (solid lines) and the shear tests (dashed lines) in terms of σ_{eq} and ε_{eq}. In (a), σ_{eq} is calculated directly from the applied stress ($\sigma_{applied}$ $\tau_{applied}$). In (b) lateral stresses of 3.5 MPa for 300°C and 2.15 MPa for 365°C are superposed for the calculation of the equivalent stress in shear. See text for discussion.

From reading the context, I would discard the manipulated lower diagram and go with the upper diagram which contains the raw data.

In Franssen's Chapter 5, equivalent to Franssen & Spiers (submitted in 1993) Influence of deformation geometry on the flow behaviour of polycrystalline rocksalt at temperatures in the range 250-600℃. J Geophysical Research, these figures can be found:

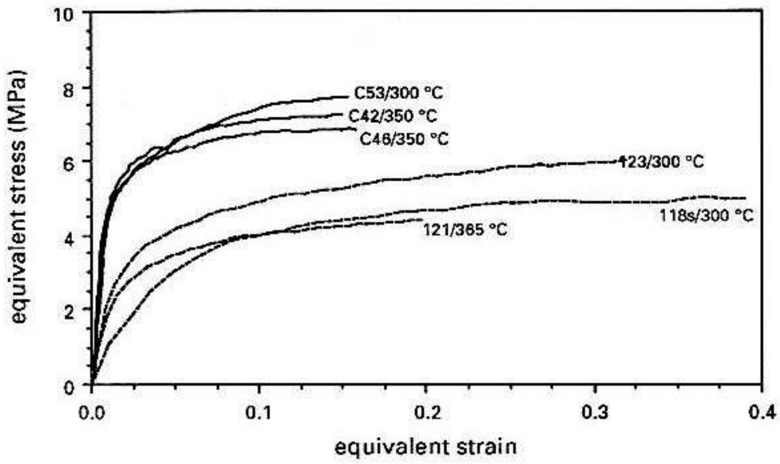

Figure 5.8:
Comparison of mechanical data from the compression tests (bold lines) and shear tests (dashed lines) in terms of σ_{eq} and ε_{eq} for the temperature range 250 - 350°C. In compression the steady state values of σ_{eq} supported are c. 1.5 times larger than in shear, under comparable conditions.

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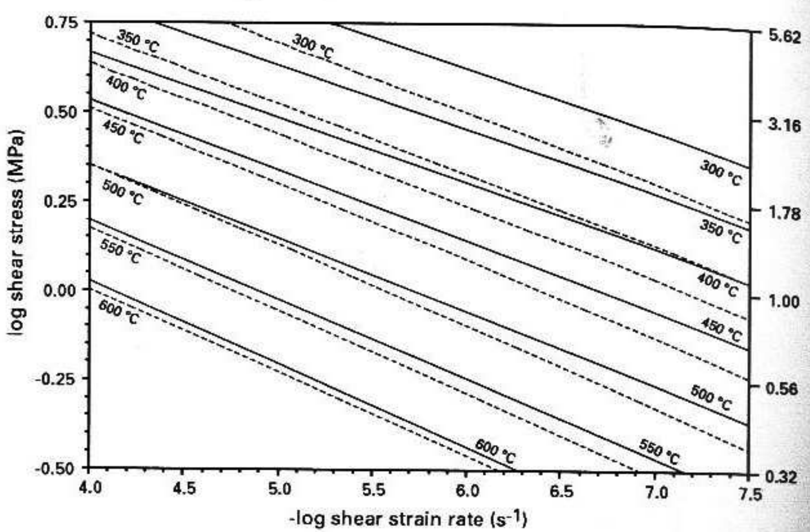

Figure 5.11:
Comparison between the shear strain rate - shear stress relations predicted by Eq. 5.18, based on uniaxial creep data (solid lines) and Eq. 5.6, based on simple shear creep data (dashed lines). The uniaxially-derived flow law predicts significantly lower shear strain rates than the simple shear flow law for temperatures below c. 450°C. For higher temperatures a favourable agreement between the two flow laws is obtained.

Simple shear requires always substantially less energy in the plastic field than axial shortening; this becomes only less apparent close to melting when diffusion processes are highly effective.

For the elastic field
Treloar LRG (1975) The physics of rubber elasticity. Clarendon Press, Oxford, Fig.5.10, p.94

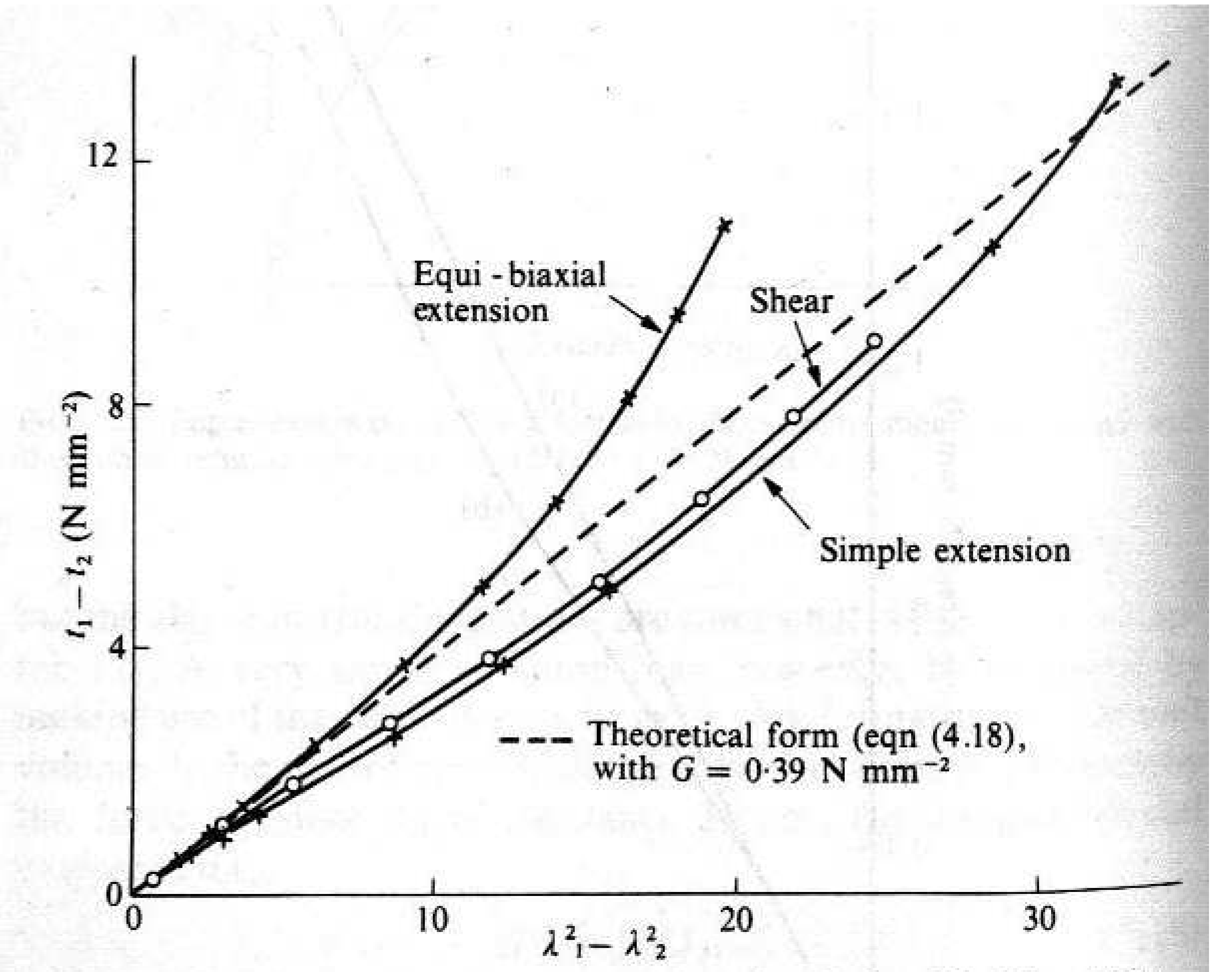

FIG. 5.10. Alternative representation of data given in figs. 5.3, 5.4 and 5.8.

From the context in the book it is clear that "simple extension" is pure shear (experimental setup shown in extra figure), and "shear" means simple shear. Simple shear costs more than pure shear, but from the graph it is hard to say precisely how much. But 10% looks like a reasonable estimate which jives with my prediction.

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