Abstract of oral presentation at the XXI general Assembly of the European Geophysical Society in The Hague, 6-10 May 1996, Annales Geophysicae, VOL. 14, Part 1, C175

PRESSURE SOLUTION: DEPENDENCE OF THERMODYNAMIC DRIVING FORCE ON GRAIN BOUNDARY STRUCTURE

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The potential energy difference (ΔU) across the rate controlling step during pressure solution (PS) is commonly assumed to be approximately equal to the mechanical work (W) done on the solid during deformation. This assumption is essential to all of the PS rate laws published in the literature to date. However, this assumption may be fine for *reversible* deformation processes, but not necessarily so for *irreversible* deformation processes, such as PS actually is. During irreversible deformation processes significant parts of W may be lost without driving the rate controlling process. Taking the irreversible character of PS into account, it appears, that ΔU may be up to 4 orders of magnitude smaller than W, depending on the nature of the PS model assumed. Hence, the PS *rate* may be up to 4 orders of magnitude smaller than predicted when the irreversible nature of PS is neglected. It also appears that ΔU (and hence the PS rate) may depend significantly on elastic anisotropy, interfacial energy, and the crystal plastic behaviour in the grain boundary zone. A comparison of experimentally determined PS deformation rates published in the literature with rates predicted by existing PS rate laws shows that in most cases the former are several orders of magnitude lower indeed.