Slip and local deformation of NaCl single crystals after "uniaxial" compression

E. Fries, C. Dolin, J. Castaing

► To cite this version:

E. Fries, C. Dolin, J. Castaing. Slip and local deformation of NaCl single crystals after "uniaxial" compression. *Revue de Physique Appliquée*, 1988, 23 (4), pp.720-720. 10.1051/rphysap:01988002304072000 . jpa-00245875

HAL Id: jpa-00245875

<https://hal.science/jpa-00245875>

Submitted on 1 Jan 1988

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Slip and local deformation of NaCl single crystals after "uniaxial" compression

E. FRIES, C. DOLIN, J. CASTAING

Laboratoire de Physique des Matériaux

CNRS, 92195 MEUDON Cedex, France

In situ reflection topography of NaCl single crystals during high temperature creep experiments [1] were performed with the synchrotron radiation at L.U.R.E. Orsay; they led us to some questions. Here two points will be reported concerning 1) the preference for slip in relation to sample geometry, 2) the heterogeneity of deformation and resulting substructure in one given sample.

1) The influence of specimen geometry on low temperature deformation of NaCl structure single crystals has been studied by Fotedar et al [2] and Soullard et al [3]. Here, the same variations of sample geometry have been used for NaCl single crystals. Parallelepipeds have been cleaved from high purity Harshaw and 99.5% NaCl blocks, the section perpendicular to compressive stress being $\ell \times (\ell + \Delta\ell) = S_0$ and the length L . The ratio L/S_0 has been maintained about 2.5 - 3.2, a suitable value to avoid buckling. The influence of the cross sectional shape of the specimens has been studied by varying the ratio $\ell + \Delta\ell / \ell$ from 1.0 to 1.2. The crystals were deformed along $\langle 100 \rangle$ under constant load (stresses σ between 0.35 MPa and 2 MPa), at elevated temperature (0.8 TM) up to large strains ($\epsilon \sim 20\%$ to 50%). From the four slip planes equally stressed, two orthogonal ones seem mainly activated, giving barrellled specimens [4]. Depending on the applied stress, the two activated slip planes correspond to a short (S) or a long (L) slip distance on face width ℓ or $\ell + \Delta\ell$. High stresses correspond to long slip distances, while low stresses correspond to short slip distances (Figure 1), the relative importance of these two domains depending on the level of impurities in NaCl.

2) Some of the previous samples were studied more accurately. Local deformation as a function of total deformation was determined after deposition of a nickel grid [5]; microstructure was studied by Berg-Barrett X ray topography (G 20 to 60). The local strain in the central part of the sample is roughly 1.7 times the macroscopic strain. Repartition of isostrain lines (Figure 2) on each sample, for various σ and ϵ values, is similar to the figure obtained by T. Bretheau and C. Dolin for Cu₂O single crystal deformed along $\langle 110 \rangle$ [5]. We found a mean subgrain size versus $1/\sigma$ fitting a straight line as previously reported for NaCl [4]. For a given sample the central region has a coarser substructure and shows a higher local strain than the peripheric regions. Similar results were found for Cu₂O [6]. CoO deformed samples showed a distribution of subgrain size [7] opposite to the one described above. The main difference between the two situations is the ratio of subgrain size to specimen dimensions [1] [6] [7]. The specimen geometry seems to play a dominant role on the local process of deformation.

Figure 1 : Influence on deformation of specimens cross sectional shape : S short slip distance, L long slip distance.

Figure 2 : Isostrain lines $\epsilon_{\text{local}}/\epsilon_{\text{macroscopic}}$.
 $\epsilon_{\text{macroscopic}} = 0.33$ $\sigma = 1 \text{ MPa}$ $T = 678^\circ\text{C}$.

- [1] Fries, E., Deschamps, J., Castaing, J., Rad. Effects 74 (1983) 329.
- [2] Fotedar, H.L., Srinivasan, M., Wilson, D.A., Stoebe, T.G., Mat. Sci. Eng., 7 (1971) 272.
- [3] Soullard, J., Mendoza, A., Orozco, E. and Montemayor, J., Jap. J. Appl. Phys. 26 (1987) 543.
- [4] Poirier, J.P., Phil. Mag. 26 (1972) 701.
- [5] Bretheau, T., Dolin, C., Journ. Mat. Sci. 13 (1978), 587.
- [6] Fries, E., Audouard, A., Bretheau, T., Rev. Phys. Appl., 13 (1978) 489.
- [7] Sanchez, M., Dominguez-Rodriguez, A., Marquez, R., Castaing, J., Phys. Stat. Sol. (a) 98 (1986) 203.