o.m5.o3 **X-ray diffraction studies on charge-density-wave deformation by carrier injection in the quasi-one-dimensional compound $NbSe_3$.** H. Requardt[a*], F. Ya.Nad[b], D. Rideau[c], P. Monceau[d], R. Currat[c], J.E. Lorenzo[e], D .Smilgies[f], G. Grübel[f]. *[a]MPI f. Metallforschung, Heisenbergstr. 1, 70569 Stuttgart/Germany; [b]Institute for Radioengineering and Electronics, 103907 Moscow/Russia; [c]ILL, B.P. 156, 38042 Grenoble; [d]CRTBT-CNRS, B.P.166, 38042 Grenoble; [e]Cristallographie-CNRS, B.P.166, 38042 Grenoble; [f]ESRF, B.P.220, 38043 Grenoble*
Keywords: low-dimensional systems.

We have determined the spatial variation of the local charge-density-wave (CDW) strain in the sliding state in $NbSe_3$. Using high spatial-resolution X-ray diffraction (30-50μm beam width) the strain is monitored by measuring the spatial dependence of the shift $q(x)$ of the CDW-satellite wave vector $(0Q(x)0)$, $Q(x) = Q_0 + q(x)$, , between the current contacts.

In earlier work[1,2] we have studied the deformation of the sliding CDW applying direct currents well above the CDW-depinning threshold (T=90 K). In this stationary state the CDW strain reveals a steep exponential decrease near the electrodes with a length scale of several hundred microns (sample length 4.1mm). Following the model developed by Brazovskii et al.[2], this decay profile is related to the charge carrier injection and associated phase slip processes, which give rise to an imbalance between normal and condensed charge carriers. This leads then to a spatially extended CDW deformation profile.

The comparison with the corresponding pulsed current data, i.e. with the non-stationary state, reveals a strong relaxational behaviour of the CDW strain between current pulses, also suggesting a significant spatial dependence of the relaxation.

At T=75 K, we investigated the CDW strain relaxation, $q_x(t)$, upon switching off the current[3]. Combining time-resolution with high spatial resolution X-ray diffraction we observe at a distance of 800μm from a current contact a decay $q(t)$ following a stretched exponential profile, $q(t) = q_0 \exp(-t/\tau)^{\mu}$, $\mu = 0.37$ and $\tau = 283$ms.

[1] H.Requardt et al.,Phys.Rev.Lett. **80**, 5631 (1998)
[2] S.Brazovskii et al., Phys.Rev. B **61** (2000), in press
[3] H.Requardt et al., J.de Physique IV **9**, 133 (1999)
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o.m5.o4 **Anomalous diffraction study of quasi-1D compound $(TaSe_4)_2I$.** V. Favre-Nicolin[ac], S. Bos[a], E. Lorenzo[a], J-F. Berar[a], J-L. Hodeau[a], R. Currat[b]. *(a) Labo. de Cristallographie, BP 166 38042 Grenoble (France) (b) ILL, BP 156, 38042 Grenoble Cedex 9 (France) (c) Laboratoire de Cristallographie, 24 quai Ernest-Ansermet, 1211 Geneva 4, (Switzerland)*
Keywords: Peierls transition, anomalous diffraction, incommensurate reflections.

Although Peierls transitions in quasi-one-dimensional metals have been studied for more than 40 years ago, the simple phenomenological electron-phonon coupling model cannot account for the variety of ground states observed in these compounds. One puzzling example is $(TaSe_4)_2I$: this compound exhibits infinite ($TaSe_4$) chains, where Ta d_{z^2} overlap create a 1D conducting band. From this one-dimensional character, and the fact that there is 0.5 electron per tantalum, one expects a low-temperature Peierls transition with a gap opening at the Fermi level and tetramerization of Ta atoms.

Experiments show that $(TaSe_4)_2I$ undergoes a phase transition to a Peierls semiconducting state below Tp=263K. But, instead of the expected tetramerization of the Ta atoms (which would correspond to a modulation vector equal to c*), the recorded diffraction shows 8 incommensurate satellite reflections around each main reflection, at (±0.08;±0.05;±0.05).

A previous analysis of the intensities of these satellite reflections showed that the involved displacements are acoustic-like, and perpendicular to the (TaSe4) chains. To explain this odd behavior, a model has been proposed[1], taking into account a coupling between the optical (tetramerization) parameters, and elastic deformations in the material.

In order to test this model, we have calculated diffracted intensities in order to find reflections highly sensitive to such tetramerization-like displacements. At room temperature, due to symmetry conditions, $[hkl]$ reflections with odd l do not have any contribution from Ta atoms to their structure factors. But simulations show that if tetramerization does occur, then some Ta contribution should appear below Tp on these reflections.

We have finally conducted anomalous diffraction experiments on the ESRF D2AM beamline, around the Ta L_{III} edge. The aim was to **selectively probe reflections for a contribution of Ta atoms** to the structure factors. We found that satellite reflections with l=4n±1.08 exhibit a large contribution from Ta atoms, whereas the corresponding main reflections (l=4n±1) and symmetric satellites (l=4n±0.92) do not have this contribution.

This anomalous diffraction experiment is the first experimental proof of the tetramerization-like displacements of the Ta atoms in $(TaSe_4)_2I$, and we will show how it validates the proposed coupling model.

[1] Lorenzo, J. E., Currat, R., Monceau, P., Hennion, B., Berger, H. and Levy, F. (1998), *A neutron scattering study of the quasi-one-dimensionnal conductor (TaSe4)2I*, J.Phys. : Condens. Matter. **10**, (1998) 5039-5068