ESRF	**Experiment title:** **Fine tuning the spin-density-wave magnetism in Cr/V heterostructures via hydrogen uptake**	**Experiment number**: He 2050
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Names and affiliations of applicants (* indicates experimentalists):

A. Remhof*, A. Nefedov*, G. Nowak* A. Liebig*[1], E. Kravtsov[2] H. Zabel

Institut für Experimentalphysik/Festkörperphysik, Ruhr-Universität Bochum, Bochum D-44801, Germany

[1]Department of Physics, Uppsala University, SE-751 21 Uppsala, Sweden
[2]present address: APS, Argonne National Laboratory, Argonne, IL 60439 USA

Report:

The itinerant antiferromagnetism in Cr has attracted considerable attention during the last 40 years. Its low-temperature behaviour is associated with the existence of spin-density-waves (SDWs) accompanied by charge-density-waves (CDWs) and strain waves (SWs) incommensurate with the bcc lattice periodicity of Cr. Whereas the SDW behaviour in bulk Cr and single Cr films is well established now [1, 2], there are a still open questions of its nature in Cr heterostructures [3]. Cr/V heterostructures are unique systems in which the SDW state was found recently to be under strong influence of proximity effects due to the hybridization between the very similar Fermi surfaces of chromium and vanadium. Our recent investigations have shown that the Cr-V interface hybridization causes a strong and long-range effect on global properties of the SDW state in Cr/V heterostructures, including change in the SDW polarisation, propagation direction and the Neel temperature [4]. Vanadium is a specific material that is able to absorb hydrogen in a reversible way from the surrounding atmosphere. This property of vanadium opens a possibility to modify its Fermi surface and, hence, the Cr-V interface hybridisation effects in Cr/V heterostructures upon hydrogen uptake.

For the investigations we used a $[Cr(500\ Å)/V(20\ Å)]_4$ multilayer grown with UHV sputtering on a (100) MgO substrate. The CDW parameters (period, propagation direction) and their temperature behaviour at different hydrogen concentration were determined with X-ray scattering experiments at the ID20 beamline. We focused on the temperature dependence of satellite peaks around the (011) and (002) Cr Bragg reflections corresponding to the CDW positions at different hydrogen concentrations.

The measurements were performed at low temperatures in the range from 15K to 320K for every hydrogen concentration.

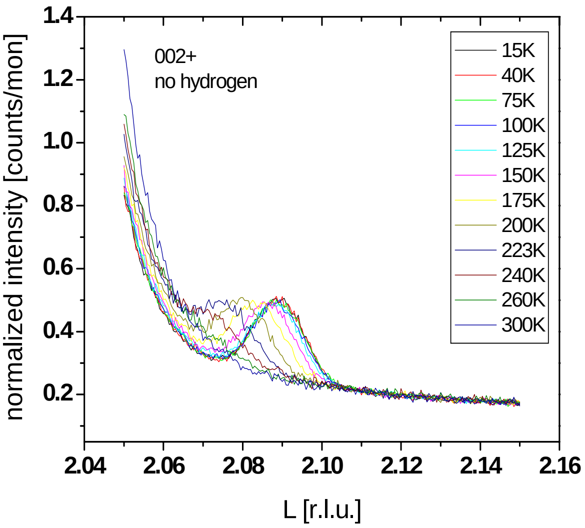

Figure 1: Temperature dependence of the (002+) CDW satellite in the H-free state.

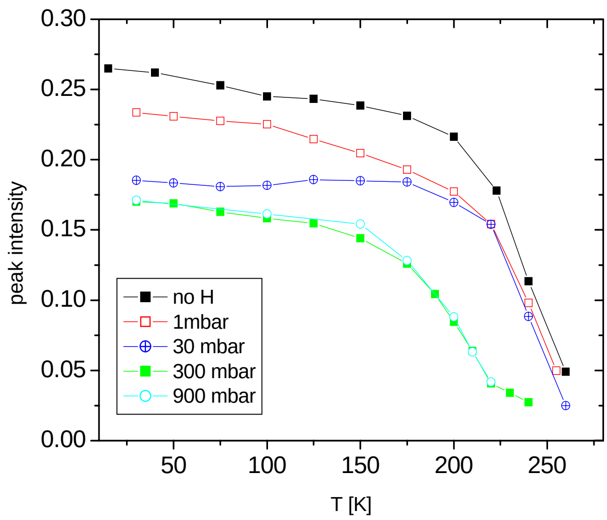

Figure 2 Intensity of the (002+) CDW satelite as a function of temperature for different H pressures

Figure 1 shows the temperature dependence of the (002+) sattelite in the hydrogen free state. No sattellite reflections could be determined around the (110) reflections, indicating a purely out-of-plane wave. Figure 2 displays the Intensity of the (002+) satellite as a function of temperature for H-pressures up to 900mbar. Two effects are observed. First, the intensity at a given temperature decreases with increasing H pressure, indicative for a lower scattering volume. Consequntly, a smaller volume fraction of the sample is ordered in the SDW state. Second, the order temperature drops from 270K in the virgin state to 220K at 300mbar, where saturation is reached in the fully loaded state. No reorientation of the wave could be observed, we never found satellites around (110). For all H-pressures an the wave only propagates along the (001) direction. Within the resolution of the instrument no shift of the structural Cr (002) reflecton could be observed. We conclude therefore, hat the H does not enter the Cr lattice.

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