ESRF	**Experiment title:** Spin-density wave magnetism in Cr/V multilayers	**Experiment number**: HE-1504
Beamline: ID20	**Date of experiment**: from: 30.04.2003 to: 06.04.2003	**Date of report**: 10.12.2003
Shifts: 18	**Local contact(s)**: S. B. Wilkins	*Received at ESRF:*

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Report:

Bulk Cr is an itinerant antiferromagnet displaying an incommensurate spin density wave (SDW), charge density wave (CDW), and strain wave (SW) below T_N=311K [1]. In recent years the SDW magnetism in thin Cr films and multilayers has attracted intensive investigations motivated by new physics arising in these systems due to proximity effects from neighbouring layers [2]. Cr/V is a system in which the SDW state was expected to be under strong influence of proximity effects causing to local supression of Cr magnetic moment at the interfaces [3]. The experiment HE-1504 was aimed to reveal possible long-range effect from neighbouring V layers on the SDWs and SWs in Cr films. The investigations were done at a V(14A)/Cr(2000A) thin film system grown on a MgO(001) substrate.

The experiment was performed at the magnetic scattering beamline ID20 at the ESRF. We have measured the temperature dependence of satellite peaks around the (011) and (002) Bragg reflections corresponding to the SW positions and also tried to find satellite peaks around the (001) and (021) reflections corresponding to the SDW magnetic peaks. The measurement was done at the Cr K-absorption edge at 5.89 keV in a vertical scattering geometry with incident linear polarisation, a PG(004) analyser was used to perform the polarisation analysis of outcoming beam selecting the σ-σ and σ-π channels.

The SW satellites were found to appear in the K direction around the Cr(011) fundamental peak. The magnetic scattering from the SDW was found to be very weak, more likely, due to small scattering volume. From the scans performed we established that the SW and SDW propagate in the layer plane, whereas the out-of-plane waves are completely supressed. In Fig. 1 is shown the temperature dependence of the SW satellites measured in the K direction around the (011) peak.

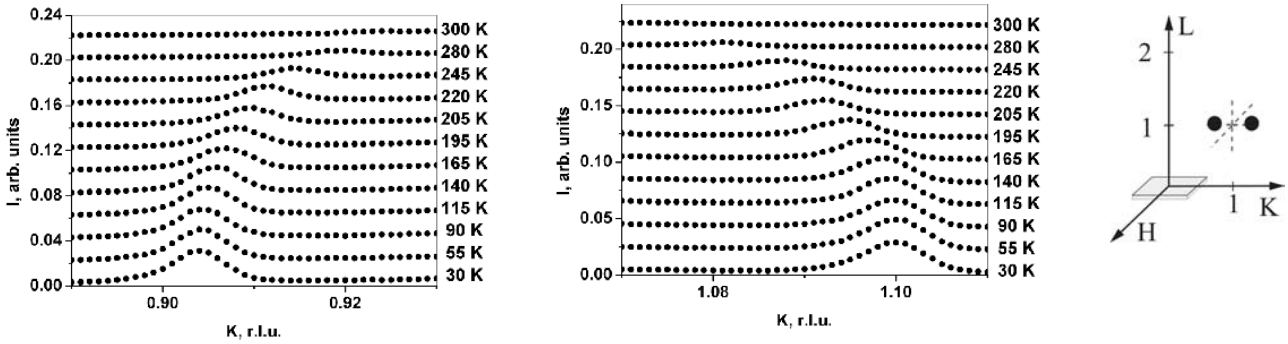

Fig. 1 Temperature dependence of the SW satellites around (011) position at 5.89 keV in the σ-σ channel. The fundamental Cr(011) peak was removed from the picture, the curves were shifted vertically at a constant value.

Surprisinly, we found an unusual long-range proximity effect of the V layer on the SDW behaviour in the Cr film, in contrast to bulk Cr, CrV alloys, and other Cr-based thin film systems. The SW period in the Cr/V film was found to be shorter than in bulk Cr as well as in other thin film Cr systems but larger than in bulk CrV alloys. Farthemore, the temperature dependence of the SW period is also different from that in the above systems. The SW satellite intensity changes with temperature in a quasi-linear fastion that is not typical for other Cr films but observed only in some CrV alloys.

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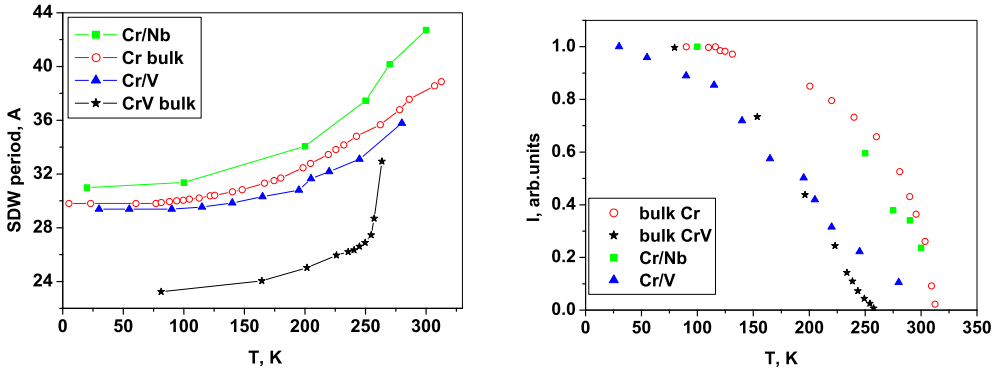

Fig.2 The SW period and the SW satellite intensity as a function of temperature in our Cr/V system and in bulk Cr, bulk CrV alloy with 0.5 % V and in Cr/Nb thin film.

References

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