ESRF	Experiment title: X-ray holography on MBE grown FePd alloys.	Experiment number: HS-508
Beamline: ID32	Date of experiment: from: l-Jul-98 at 7am to: 9-Jul-98 at 7am	Date of report: 28 Aug 98
Shifts: 21	Local contact(s): R. Felici	*Received at ESRF:*

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Preliminary Report

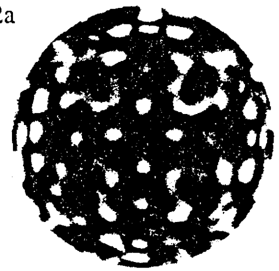
We have done three x-ray holographic experiments at ESRF. In the first (MI174), holographic information were not obtained because of technical problems. However, the Kossel and standing wave line patterns were recorded [1]. In the next experiment (MI 228) the technical problems connected to the mechanical motions of the analyser-detector assembly were solved and holograms of NiO and Co0 samples were taken [2].
In the present experiment HS 508, we used an improved version of the crystal analyser [3] and applied the technique to FePd epitaxially gown thin layers. In spite of the several technical difficulties we could take holograms of two FePd(50nm)/MgO(001) samples at two energies. This is the first time that X-ray Fluorescence Holography (XFH) is performed on a thin film.
The experimental setup was similar to the one developed in the previous experiment (MI 228) except the analyser. It consisted of two coaxial independent vertical rotations and a horizontal axis fixed to one of the vertical ones. The analyser-detector system was fixed on the other vertical axis. Since the fluorescent yield from a thin epitaxial layer is much lower than that from the bulk samples used in our earlier studies, we had to increase the efficiency of our analyser-detector system to get enough counts in the given experimental time. This was achieved by extending the graphite bent analyser crystal to a full cylinder, see Fig. 1. (i.e. four times as large as in the case of the earlier version, see the report of MI 228). This. and the He path which we built, resulted in about a factor of 40 increase of intensity. in a bulk sample we estimated about $3*10^7$ counts/sec (this could not be directly measured. we had to use absorbers). For the 50 nm-thick FePd samples. the count rate was in the range of $10^5 sec^{-1}$, enough to make holography measurements in about one day.
As a reference. an $Fe_{70}Ni_{30}$ single crystal was first measured. After getting the proper hologram on it, we continued with the measurement on a chemically ordered and a partially ordered FePd epitaxial layer. The measurements were done in the inverse mode at 15 and 17 keV. Preliminary evaluation shows that holograms could be recorded. Fig.2a shows the hologram of the ordered sample; after background deconvolution. the 4-fold symmetry is clearly apparent. Reconstruction was done only for this sample because of the limited time since the experiment (Fig 2b). With a thorough evaluation we expect to gain useful information on the local chemical environment of the Fe atoms.
A more detailed picture of the system could be obtained if we could do additional measurements in the normal XFH mode and also at more energies. as we originally planned but time limitations did not allow these.

References

1. S. Marchesini et al. Solid State Commun.105 (1998) 685.
2. M. Tegze et al. to be published.
3. S. Marchesini et al. SPIE Proceeding 3448-24 (1998)

1

2a



2b

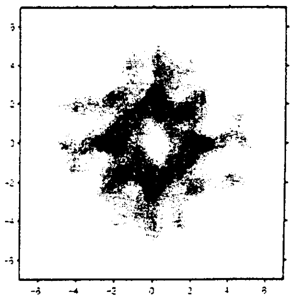


Fig. 1 Cylindrical graphite analyser
Fig. 2 a) FePd hologram (ordered sample)
b) in-plane reconstruction