ESRF

ESRF	**Experiment title:** Chemical order in ultrathin alloy films by using „Pink Beam"	**Experiment number:** MI-377
Beamline: ID22	**Date of experiment:** from: 17.11.99 to: 23.11.99	**Date of report:** 24.02.2000.
Shifts: 18	**Local contact(s):** Alexandre Simionovici	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

*M. Tegze	Res. Inst. for Solid State Phys. and Optics
*G. Faigel	Res. Inst. for Solid State Phys. and Optics
*S. Marchesini	CEA-Grenboble DRFMC/SP2M/IRS
*M. Belakhovsky	CEA-Grenboble DRFMC/SP2M/IRS
*O. Ulrich	CEA-Grenboble DRFMC/SP2M/IRS

Report:

The aim of this experimental run was twofold: (i) technical development of the methodology
(ii) the study of the chemical short rang order in epitaxially grown thin films

Previous experiments showed that the collection of a full holographic data set with proper statistics from a bulk sample takes at least half a day. In the case of thin layers the fluorescent intensity drops significantly leading to very long measuring times. However, taking into account the requirements of holography (concerning monochromaticity), it is clear that one could use a single undulator harmonic without additional crystal monochromator. Rough estimates gave about 200 times increase in the intensity of the fluorescent signal. This promised a reasonable measuring time even for thin layers. However, the use of the pink beam required several modification to our earlier setup, such as the change of the single photon counter to integrating detector in current mode, effective prevention of radiation damage etc.

Although we encountered a periodic noise problem coming from the storage ring, we were able to solve this at least partly, and carry out our program successfully. The results of the measurements are very promising. We can measure a hologram of a bulk sample with good enough statistics in about one minute. Unfortunately, the earlier mentioned periodic noise prevent the holographic reconstruction of one minute spectra in spite of the proper counting statistics. However, averaging 10-20 spectra decreases the distorting effect of the periodic intensity modulation and good quality reconstruction becomes possible. Using this improved setup we took holograms of two FePt epitaxial layers at several energies. The measuring time at a single energy was about half an hour. Preliminary evaluation shows that different chemical short range order in the two samples can be distinguished. In addition to these experiments we could accomplish our earlier plan (see MI272): the imaging of light atoms, which was prevented by monochromator instabilities at ID18. Further, we successfully measured a quasi single crystal. From the above work three papers are in preparation.

For illustration we show the holograms (and SDW line patterns) of three samples having 3, 4 and 5 fold symmetry axis perpendicular to the sample surface.

The holograms and standing wave line patterns of NiO (111), FePt (100) thin layer and AlPdMn quasi crystal (from left to right, respectively).