



Beamline: ID31	Experiment title: Phase separation and anomalous thermal expansion in diborides	Experiment number: HS-2195
	Date of experiment: from: 15-Feb-06 to: 20-Feb-06	Date of report: 02-August-2006
	Shifts: 15	Local contact(s): Andy Fitch
Names and affiliations of applicants (* indicates experimentalists): Matteo Filippi , Antonio Bianconi, Naurang L. Saini, Laura Simonelli*, Valerio Palmisano*, Michela Fratini. Unità INFM and Dipartimento di Fisica, Università La Sapienza, Piazzale Aldo Moro 2, 00185, Roma (Italy)		

Report:

The aim of this experiment was to study the phase separation in diborides and to explore the correlations between a possible thermal expansion anomaly and the superconductivity in these materials. In our previous experiments we have performed the study of the low-temperature thermal expansion on $\text{Al}_x\text{Mg}_{1-x}\text{B}_2$ system. First (experiment number hs2276) we found a large negative thermal expansion (NTE) in MgB_2 and we obtained that NTE is more than twice for $x=0.16$ and disappears for $x=0.50$ [1]. Again (experiment number hs2729 and hs2969) we obtained the thermal expansion of the compound made of the isotope ^{10}B and ^{11}B , however, it was not possible to quantify the NTE for intermediates Al contents ($0.16 < x < 0.37$) due to phase separation.

During the assigned beam-time for the present experiment we performed systematic study of diffraction profiles of the system $\text{Al}_x\text{Mg}_{1-x}\text{B}_2$ (both ^{10}B and ^{11}B) with Al content in the range $0 < x < 0.60$ in order to study the evolution of the phase separation. We measured about 50 samples.

In figure 1 we present an example of a phase-separated peak relative to c-axis: there is an interesting evolution going from MgB_2 to the compound $\text{Al}_{0.57}\text{Mg}_{0.43}\text{B}_2$. We are going to improve our analysis to establish if we are facing a real phase separation. We also tried to measure the anomalous thermal expansion of the sample with Al content $x \sim 0.075$ where the two phases are not much separated but no signature of anomalous thermal expansion was found.

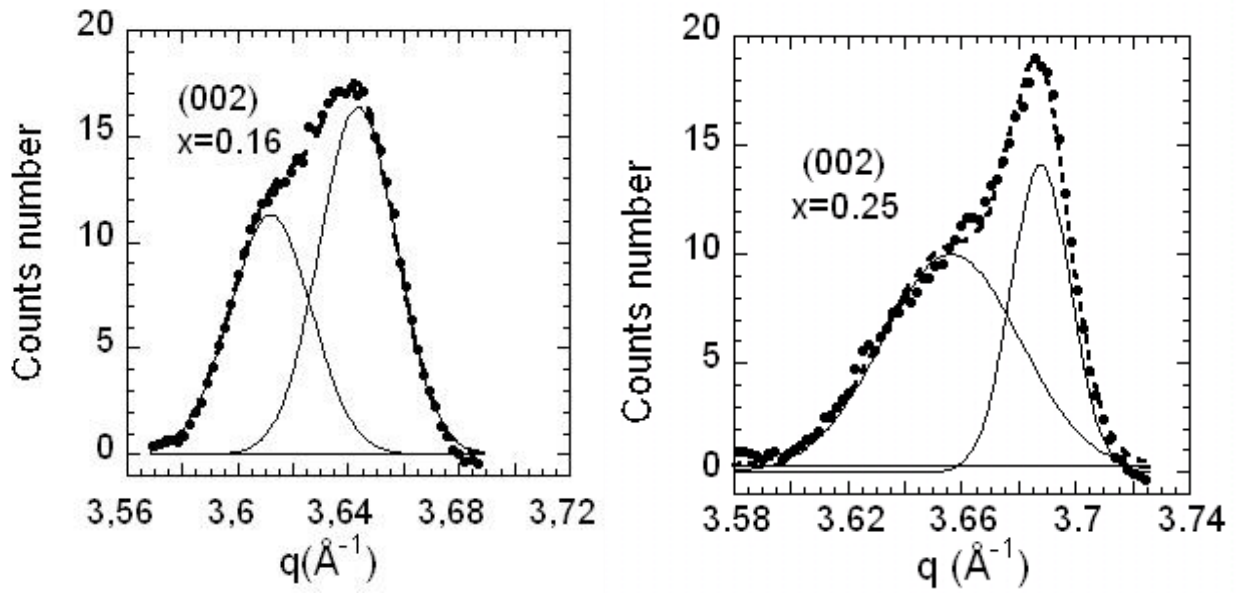


Fig.1 Peaks (002) in the $x=0.16$ (fig. 1a) and $x=0.25$ (fig 1b) compounds. Each peak may be fitted with a two-phase model (dashed line) and each phase is plotted as a solid line.

A detailed analysis of the phase separation in the samples studied during the experimental run is underway.

[1] V. Palmisano, S. Agrestini, G. Campi, M. Filippi, L. Simonelli, M. Fratini, A. Bianconi, S. De Negri, M. Giovannini, A. Saccone, A. N. Fitch, M. Brunelli and I. Margiolaki, *Journal of Superconductivity: Incorporating Novel Magnetism* **18**, 737 (2005).