



	<b>Experiment title:</b> Structural properties of $\text{MgB}_{2-x}\text{C}_x$ superconductors	<b>Experiment number:</b> CH-1135
<b>Beamlines:</b> BM16	<b>Date of experiment:</b> from: 8/4/01 to 12/4/01 and 23/11/01 to: 26/11/01	<b>Date of report:</b> 1/3/02
<b>Shifts:</b> 9/9	<b>Local contact(s):</b> A N Fitch	<i>Received at ESRF:</i>
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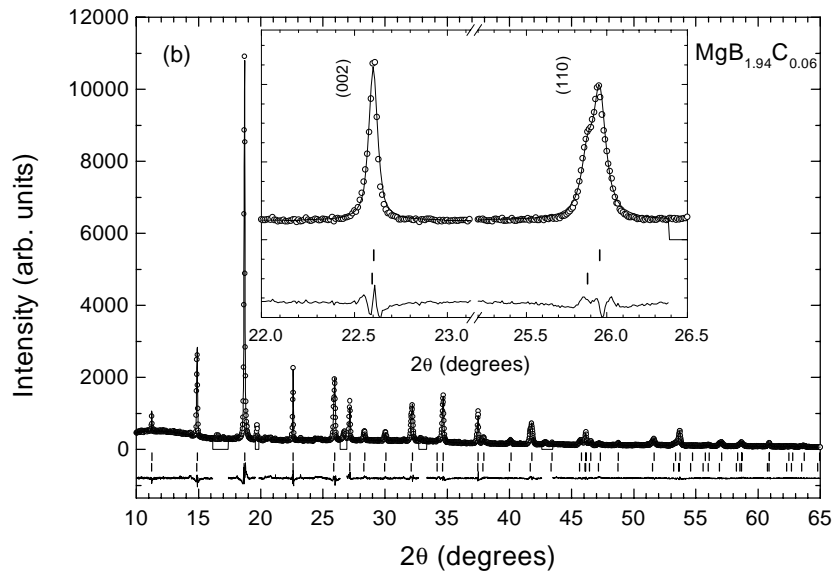
### Report:

Abstract of publications resulting from this proposal:

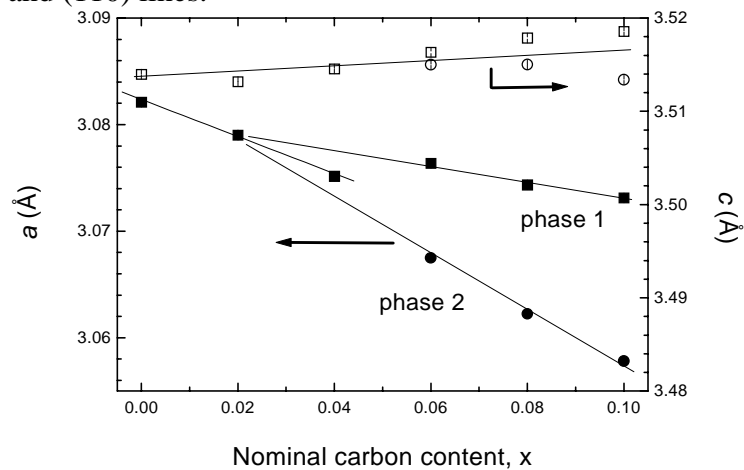
*Physica B*, **2002**, in press and *Chem. Mater.* submitted.

### Carbon Miscibility in the Boron Layers of the $\text{MgB}_2$ Superconductor

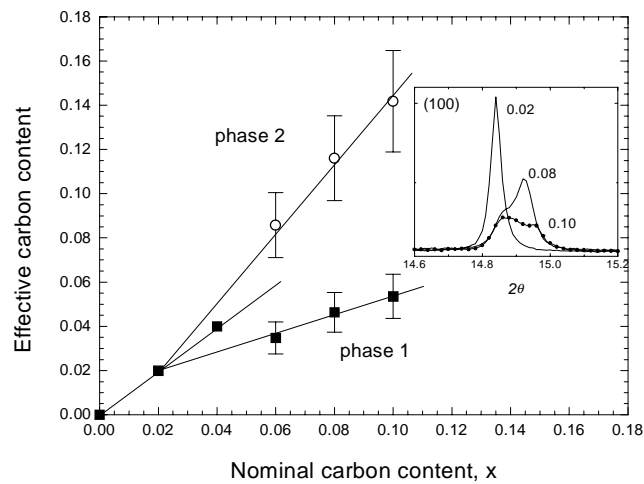
A detailed structural analysis of the  $\text{MgB}_{2-x}\text{C}_x$  series at low doping levels ( $0 \leq x \leq 0.1$ ) is presented. High-resolution X-ray powder diffraction experiments show an extremely small miscibility of carbon within the boron sheets despite the structural analogy between  $\text{MgB}_2$  and graphite. Multi-phase behavior is detected for  $x \geq 0.04$ . The coexisting phases, isostructural with the parent  $\text{MgB}_2$  compound, differ mainly in their in-plane lattice constants, as evidenced by the splitting of the  $(hk0)$  Bragg reflections. All phases contain carbon in substitution for boron but in different concentrations.



**Fig. 1** Observed (open circles) and calculated (solid line) synchrotron X-ray diffraction profiles for  $\text{MgB}_{1.94}\text{C}_{0.06}$  at 16 K ( $\lambda = 0.6889 \text{ \AA}$ ). The lower solid line shows the difference profile and the tick marks show the reflection positions. Impurity peaks arising from MgO were excluded from the refinements. Inset. Enlarged views of the (002) and (110) lines.



**Fig. 2** Lattice constants at 16 K as a function of the nominal carbon content,  $x$  in the  $\text{MgB}_{2-x}\text{C}_x$  series ( $0 \leq x \leq 0.1$ ).



**Fig. 3** Effective carbon content derived from the linear variation of the  $a$ -lattice constant with the carbon concentration in the boron sheets in Fig. 2 as a function of the nominal carbon concentration in the  $\text{MgB}_{2-x}\text{C}_x$  series. Inset. The (100) reflection for selected compositions.