



	<b>Experiment title:</b> Peritectic Phase Transformation during Solidification using Synchrotron Radiation	<b>Experiment number:</b> MA-3300
<b>Beamline:</b>	<b>Date of experiment:</b> from: 02/11/2016 to: 08/11/2016	<b>Date of report:</b> 30/01/2017
<b>Shifts:</b>	<b>Local contact(s):</b> Dr. Raffaella Torchio	<i>Received at ESRF:</i>

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## Report:

Here we present *in-situ* XAS measurements on melting and solidification of pure iron and several iron alloys. The data was collected on beamline ID24 using the laser heating system on 4 $\mu$ m thick metal foils fluxed with an atmosphere of He +2%H to prevent excessive oxidation.

Sample A (Pure Iron) was sourced from Goodfellow. The remaining alloys were created at the University of Warwick and rolled to 4 $\mu$ m by Goodfellow. The composition of the alloys studied are communicated in Table 1.

*Table 1: Experimental Alloy Compositions*

Sample	C(wt%)	Mn (wt%)	Al (wt%)	Ni (wt%)	Fe(wt%)
A	~	~	~	~	99.99
B	0.042	0.323	~	~	Bal.
C	0.113	0.494	~	~	Bal.
D	~	~	8	~	Bal.
E	~	~	~	30	Bal.

In this experiment we probed the solidifying primary phase during rapid solidification. Each foil was loaded in a simple holder fabricated at ESRF and heated with two YAG (1064 nm) lasers. Measurements were taken at the Fe-K edge (7.1109 keV). Some figures taken from a manuscript being prepared for publication are presented.

Figure 1 shows, a) Normalised XAS near the Fe-K edge shown as a function of time for a Fe (Alloy A), b) fitted data depicting the extracted phase fractions during melting and c) during solidification. Figure 2 shows, fitted data depicting the extracted phase fractions for a) Alloy E where the primary solidifying phase is FCC and b) Alloy D where the primary solidifying phase is BCC. The laser ‘pulse’ thermal cycle has enabled the exploration of rapid solidification phenomena *in-situ*. It was found in Fe-C alloys primary BCC solidification could be avoided, an investigation exploring solidification under controlled cooling using programmed laser ramps would be of great interest.

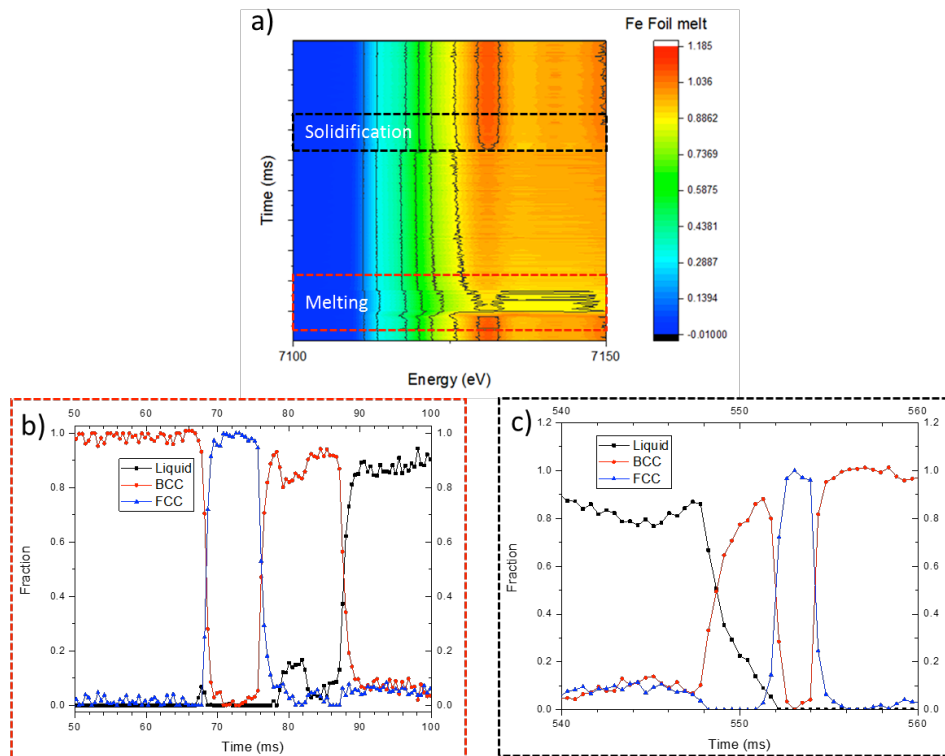


Figure 1: a) Normalised XAS near the Fe-K edge shown as a function of time for a Fe (Alloy A), b) fitted data depicting the extracted phase fractions during melting and c) during solidification.

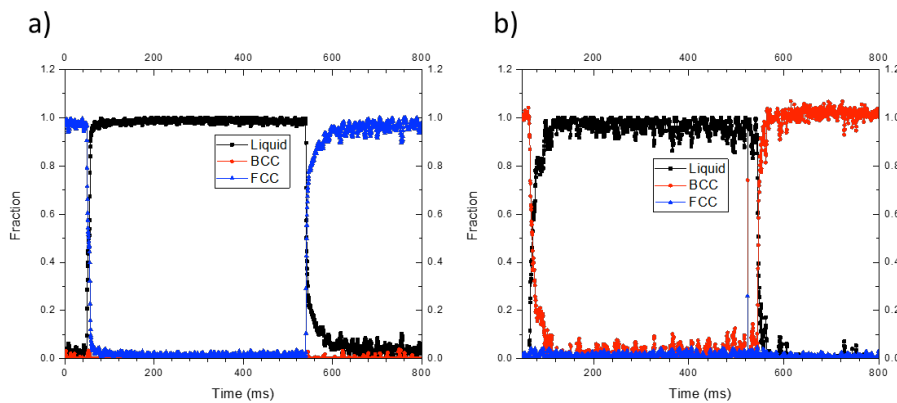


Figure 2: Fitted data depicting the extracted phase fractions for a) Alloy E and b) Alloy D