Experimental report

05/02/2016

Proposal: 1-04-83 **Council:** 4/2014

Title: thermal neutron damage in boron carbide

Research area: Materials

This proposal is a new proposal

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Samples: B4C

Instrument	Requested days	Allocated days	From	To
D16	7	2	22/04/2015	24/04/2015

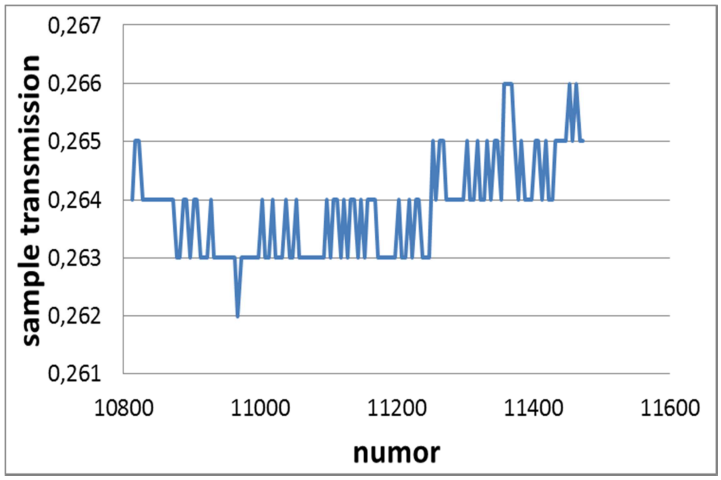
Abstract:

B4C is the material that will be used as neutron absorber in the future ASTRID reactor. In operating conditions it will be submitted to several irradiation fields. Here we want to study solely the damage produced by neutron capture on 10B. For that purpose, neutron diffraction patterns in reflection mode will be measured on a flat B4C sample as a function of time. Thus we aim at characterizing the damage created by neutron absorption in a surface layer by the progressive changes it induces in the diffusion pattern measured at small angles. A set of a few samples with different 10B enrichment will be first tested in order to determine the best experimental conditions for this original experiment.

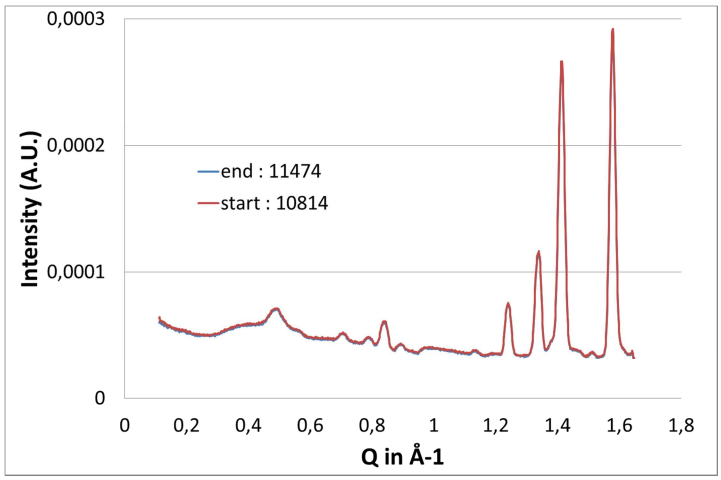
Report on experiment 1-04-83

We made a proposal at ILL in 2014 to perform experiment on D16 instrument in order to characterize the defect that are formed at the beginning of irradiation by thermal neutron in B_4C. The proposal included 2 days devoted to tests and 5 days of irradiation. Only the 2 day test was given for experiment 1-04-83. Neutron diffraction experiments were performed in April 2015 on two samples.

1- The first experiment was performed in transmission mode on a 5 mm thick B4C sample depleted in ^{10}B (0.35%) in order to decrease the sample absorption. The sample transmission was measured as a function of time together with the diffused intensity. The sample was set in the D16 neutron beam and both the transmitted neutron beam and the low angle diffraction pattern were recorded as function of time. No obvious changes appeared on the diffraction pattern but a small, yet significant, increase of the transmitted neutron intensity, about 1%, was observed. This result confirmed the decrease of ^{11}B concentration in the sample due to neutron capture and transmutation in ^{7}Li. Yet the quantity of transmuted ^{11}B is still too low to produce visible changes in the diffraction pattern.



sample transmission as a function of the acquisition numor



diffraction patterns at the beginning and at the end of the acquisition that lasted ½ day

This experiment was performed twice on the same sample giving the same evolution

2- The second experiment was performed in reflection mode on a 10B enriched B4C sample (48%). The specular diffraction line was observed at low angle in the diffraction pattern, but no other diffraction line was observed. These data are being processed.