Experimental report

13/02/2018

Proposal: TEST-2716 **Council:** 4/2016

Title: Structure of Bornite magnetic

Research area:

This proposal is a new proposal

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Local contacts: Thomas HANSEN

Samples: Cu5Fe2S4

Instrument	Requested days	Allocated days	From	To
D20	1	1	15/11/2016	16/11/2016

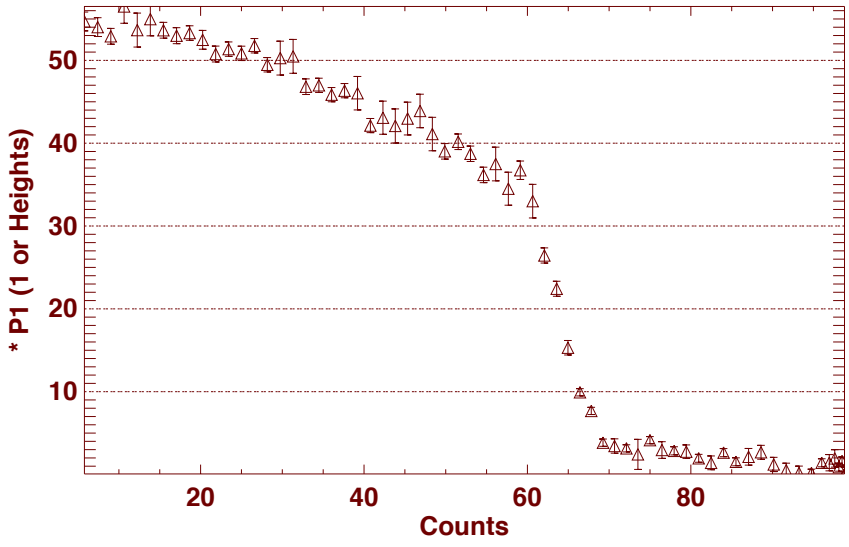
Abstract:

ILL RESEARCH PROPOSAL TEST 2716
Title: Structure of Bornite magnetic

Proposers: MONDELLI Claudia, Andres Giaccherini, Local Contact: Thomas Hansen

Beam time: 15/11/2016 – 16/11/2016

Bornite is among the most interesting natural sulphides for its peculiar magnetic proprieties, whose origin is far to be understood. Bornite shows special semiconducting and magnetic properties used in several high-tech materials, such as diluted magnetic semiconductors or thermoelectrics provided that the metal ions are ordered in the structure. Several synthetic pathways have been reported, but its application as a technologically relevant material is impaired by some open questions about it structure. Particularly, its magnetic structure, mostly unknown, it is necessary to explain the true metals localisation and valence in the Bornite crystal structure. We use high resolution neutron diffraction to solve the magnetic structure and answer these open question, enabling the application of Bornite as a technologically interesting semiconducting material.
During the test experiment we measured the NPD diffraction patterns on both natural and synthetic powder samples of bornite. Natural specimen comes from a locality (Montecatini Val di Cecina mine, Italy) renowned for its Cu sulphide ore, consisting mostly of bornite. The specimen will be enriched in bornite, the possible associated phases belonging to the group of Cu(I) sulphides (i.e. chalcocite, djurleite, digenite, anilite). Synthetic samples have been realised through a complex multi-run procedure from the elements in vacuum conditions, lasted more than 15 days, and consists of pure orthorhombic “low” bornite.
We used a a wavelength of 2.41A and the temperature varied from T room down to 4 K



Variation of the intensity of the magnetic peak at 42 degrees with temperature.