

Proposal: 1-02-126 **Council:** 4/2012

Title: Texture development during dynamic recrystallization in ice

This proposal is a new proposal

Research Area: Materials

Main proposer: MONTAGNAT MAURINE

Experimental Team: MONTAGNAT MAURINE
 CHATEIGNER Daniel
 LUTTEROTTI Luca

Local Contact: OULADDIAF Bachir

Samples: H2O

Instrument	Req. Days	All. Days	From	To
D19	4	4	29/10/2012	02/11/2012

Abstract:

Dynamic recrystallization (DRX) which can occur during viscoplastic deformation of metals and minerals induces strong changes in microstructure and texture, and thus in mechanical properties. Current knowledges on the fundamental mechanisms associated with dynamic recrystallization are still limited, in particular for nucleation mechanisms. The present project is focused on DRX on ice. First because DRX is strongly impacting the textures and microstructures of ice in natural environments such as glaciers and ice sheet. Secondly because ice, being a highly anisotropic material, is currently seen as a model material. Indeed, its high viscoplastic anisotropy induces strong strain heterogeneities which are in favour of DRX mechanisms. To our knowledge, there exist no high resolution data of texture evolution during the early stage of DRX in ice, mostly due to the difficulty to obtain data on the very small first nucleus. Samples will be deformed at different levels prior to and during DRX and further analysed in the D19 diffractometer. The CAPS detector provides a 2theta resolution adequate for this analysis aiming at quantitatively determine the orientations of ice nucleus.

Experimental report

“Texture development during dynamic recrystallization in ice”

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M. Montagnat, LGGE, UJF-Grenoble 1 / CNRS, St Martin d’Heres, France

B. Ouladdiaf, Diffraction Group, ILL, Grenoble, France

D. Chateigner, CRISMAT, ENSICAEN / CNRS, Caen, France

The aim of this experiment was to measure texture evolution in polycrystalline ice samples deformed in the laboratory under compressive creep at various strain level. The compression creep tests were performed in conditions that favoured dynamic recrystallization mechanisms (nucleation of new grains, grain boundary migration). The aim of the observations at the diffractometer D19 were the following :

- evaluate the possibility to measure texture in H₂O ice without too strong background due to hydrogen incoherent scattering
- test the cryostat device available at D19 to work at low temperature on ice samples
- extract the texture signal associated with the nucleation of new grains.

We first encountered a few technical problems with the cryostream used for the time for this experiment, but we managed to find a suitable configuration that enabled us to study 9 samples deformed at different strain levels.

Due to the hydrogen incoherent scattering, the acquisition time was very long (up to 12 hours) to extract enough signals and diffraction peaks.

The data treatment appeared more complicated than presumed, and is still being done.

This first experiment was rather successful, and the collaboration got extended via an ANR project involving Maurine Montagnat and Bachir Ouladdiaf to perform original analyses of dynamic recrystallization mechanisms in ice using neutron diffraction, on the CYCLOP diffractometer.