EUROPEAN SYNCHROTRON RADIATION FACILITY

INSTALLATION EUROPEENNE DE RAYONNEMENT SYNCHROTRON

Experiment Report Form

	Experiment title: Learning form the Brittlestar how to toughen ceramics: studying bio-inspired prestressed calcite	**Experiment number**: CH 5156
Beamline: ID22	**Date of experiment**: from: 10 May 2018 to: 15 May 2018	**Date of report**: 19/02/2020
Shifts: 15	**Local contact(s)**: MOGODI Mashikoane Wilson	*Received at ESRF:*

Names and affiliations of applicants (* indicates experimentalists):

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Report:

The work performed during this beamtime was published in: Livne A, Mijowska S.C, Polishchuk I, Mogodi M.W, Katsman A and Pokroy B. A fungal mycelium templates the growth of aragonite needles. ***J Mater Chem B*** 2019; 7:5725.

Abstract:

Fungi live within diverse environments and survive well under extreme conditions that are usually beyond the tolerance of most other organisms. In different environments fungi are known to induce precipitation of a wide range of minerals. Various species of fungi have been shown to facilitate calcium carbonate mineralization. Here, inspired by examples of needle-fiber calcite formed *via* fungus-induced biomineralization typically observed in soils and sediments, we utilized inactivated fungus to synthetically induce precipitation of $CaCO_3$ needles. To our knowledge, the feasibility of growing aragonitic needles within fungal mycelium *in vitro* has

not been previously demonstrated. The needles we obtained were curved, displayed hexagonal facets, and demonstrated high-aspect ratios close to 60. The size and shape of these synthetic needles matched those of the mycelium of the natural fungus. Utilizing high-resolution characterization techniques, we studied the morphology and the micro- and nanostructures of the aragonitic needles. Our findings showed that even inactivated fungal mycelium, if present in the crystallization environment, can serve as a template for the formation of high-aspect ratio fibers and can stabilize metastable polymorphs.