

CONTRATOS PREDOCTORALES 2022 SEVERO OCHOA

PROJECT TITLE / JOB POSITION TITLE:

New Surfaces for Ice Making Future Sustainability (SurfICE)

JOB POSITION RESEARCH LINE:

RL1 - Sustainable Energy Conversion and Storage Systems

RESEARCH PROJECT / RESEARCH GROUP DESCRIPTION:

The demand for industrial ice making systems is growing rapidly in seafood and meat food processing industries to keep raw ingredients and final products frozen and fresh. Global warming will certainly increase the demand of ice production in the coming years due to increase on temperatures and the difficulty to keep fresh seafood, meat or even vegetables at high temperatures during transportation and storage. Companies operating in the ice maker industry are making large investments in R&D activities to innovate in new technologies that will aid to reduce the overall consumption of electricity and water. Ice makers are all based in approximately the same technology, a standard refrigeration system cools down a surface, usually of stainless steel and when water enters in contact with the cooled surface it freezes, making ice. Obtaining the highest ratio of ice formation with the higher cool down temperature (the closest temperature to 0°C) is the key to minimize power consumption.

The main goal of the project is to investigate the use of surfaces from different materials (functionalized feldspar minerals, self assembled monolayers,..) activated to increase the efficiency of ice production by optimizing the nucleation temperature and to test them in real commercial ice making machines. The project is based in new developments from previous results from the group applied to snowmaking and patented worldwide. In the first part of the project our goal will be to establish which surfaces can be used for the highest efficiency, how to obtain the surfaces and how to functionalize them to activate them. We are going to investigate their efficiency to induce ice nucleation for water volumes relevant to ice making application, contrary to previous studies focused on atmospheric chemistry, that were limited to small water droplets. In the second part we are planning incorporate those materials to commercial ice making machines to investigate the viability of using them and evaluate the efficiency in saving power consumption. A success in the proof of concept can be of interest for different applications, from domestic ice-making machines, large production of ice for food industry or controlled water freezing for water treatment and purification.

JOB POSITION DESCRIPTION:

The student must have a degree on physics, chemistry or engineering. He/she will prepare samples, characterize them and test their efficiency for ice nucleation in order to establish a list of the better surfaces/materials to be tested in a real ice-making machine in the second part of the project. In order to do so the student will use techniques such as atomic force microscopy (AFM), X-ray Photoelectron spectroscopy (XPS), optical microscopy (contact angle, high speed cameras), environmental scanning electron microscopy (E-SEM). Previous experience in the use of these techniques will be considered very positively.

In the second part of the project a prototype of an ice-making machine including our functionalized surfaces will be build in the project and he efficiency of the prototype will be verifies. In this part the student will participate in the design and built of the prototype so knowledge on mechanical/electrical engineering is also considered positively. The project offers not only the possibility of having high rank publications but to participate in new technological developments suitable to be patented.

GROUP LEADER:

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Research project / Research Group website <https://surfaces.icmab.es/>