DESCRIPTION FOR THE GENERAL PUBLIC (IN ENGLISH)

(State the objective of the project, describe the basic research to be carried out, and present reasons for choosing the research topic - max. 1 standard type-written page)

It is known from the literature that the melting temperature of some compounds (such as water) confined in the pores of activated carbon is dramatically reduced as compared to the bulk. Similarly, preliminary experiments conducted by the partners of the project have demonstrated a lowering by ca. 55°C when an ionic liquid, namely [EMIm][FSI], interacts with the pores of an activated carbon of average pore size ca. 1.00 nm. Knowing that ionic liquids (ILs) are exclusively made of ions (without solvent molecules), it then becomes possible in the present project to plan studying the interaction of ions with nanopore walls, so-called electrical double-layer (EDL) charging, during electrical polarization of an electrode at low temperature. However, keeping in mind that the carbon electrode is soaked by an excess of electrolyte, such low temperature measurements must be performed with the IL electrolyte kept in liquid state, i.e. using appropriate binary mixtures of ILs. Then, from the collected experimental data, it will be possible **to elaborate a model of IL ions interaction with nanopore walls at low temperature.**

To conduct the proposed basic research project, a number of carbons with average pores size up to few nanometers and high purity ionic liquids (ILs) with the highest electrical conductivity and lowest viscosity will be selected. Binary mixtures of ILs will be realized in order to identify the eutectic mixtures with the lowest melting temperature, which will be further used as an electrolyte for our experiments. The melting temperature of IL electrolytes interacting with carbon nanopores will be measured without and with applying an electrical polarization. The difference of structure of ILs confined in the nanopores, depending whether or not a polarization is applied, will be analyzed by X-ray diffraction and neutron diffraction techniques. Traditional electrochemical techniques together with advanced *in-operando* techniques (electrochemical quartz crystal microbalance – EQCM – and dilatometry) will be used to determine charge propagation and ions fluxes when an electrode is polarized, enabling to tackle the mechanisms in play during charge storage (EDL charging) at low temperature.

The final deliverable of the project will be a model of EDL charging at low temperature. One can expect that the guest/host interactions between ions and pore walls might be very different of those occurring with the covalent compounds (water, organic solvents, …) studied until now, giving rise to novel fundamental concepts related to ions confinement in carbons.

Beside the undeniable scientific interest developed above, the choice of this research topic is also justified by potential applications of the IL/carbon interfaces, e.g., in sensors, energy storage systems and in microelectronics. From the identified carbon/IL couples operating at low temperature, it would become possible to forecast applications in devices adaptable to various climatic conditions, with temperatures ranging from -40°C to at least 100°C. This would have for example an impact in space and aircraft industry where a low temperature operation is mandatory, while implementing environment friendly and safe systems.