

# MATERIALS SCIENCE AND TECHNOLOGY

## ASI - Development of nanomaterials and devices for the direct storage of light-energy

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<b>Context of the research activity</b>	In this PhD project, the target will be to develop crystalline nanomaterials in the form of colloids to be casted into thin-film architectures capable of absorbing light-energy, generating separated charges and store them.
<b>Objectives</b>	<p>The doctoral project will have three main objectives:</p> <ol style="list-style-type: none"> <li>1) Design and synthesis of nanomaterials undergoing a photo-charging effect;</li> <li>2) Development of the photo-storage electrodes;</li> <li>3) Development of complete devices and microdevices for photo-energy storage.</li> </ol> <p>The target technology will offer a solution where light absorption, charge separation and storage will be combined in the same set of materials along with the ability to store and transfer more delocalized charges after light absorption. The devices will be built around photo-storage electrodes based on colloidal nanocrystals of doped non-critical metal oxides/chalcogenides/halides.</p> <p>The technology will be particularly suitable for autonomous solar energy conversion and storage systems. The first device design will find similarity to electrolytic-type supercapacitors in a sandwich structure but with the advantage of exploiting in situ charging with light. Specific electrode capacitance, stability, energy and power density, and cycleability after photocharging will be extracted and related to the state of the art of supercapacitor devices. The values <math>\eta</math> relating to the photon conversion efficiency will be further discussed.</p> <p>The activities carried out during this project will range from fundamental research activities to technology transfer towards a proof-of-concept tested in a laboratory environment. It will be necessary to test a number of different material systems and their deposition from solution into functional electrodes, defining experiments that allow to validate their performance by defining specific key parameters.</p>
<b>Skills and competences</b>	- Advanced chemical synthesis and characterization

**competencies  
for the  
development of  
the activity**

- Physical chemistry
- Electrochemistry
- Solution-processing methods for thin films