

RESEARCH TOPIC FOR THE PARISTECH/CSC PHD PROGRAM
(one page maximum)

Field: Chemistry, Physical Chemistry and Chemical Engineering

Subfield: Analytical and Physical Chemistry, Materials

Title: *In situ analytical approaches to understand environmental stability of materials for energy.*

ParisTech School: Chimie ParisTech | PSL

Advisor(s) Name: VOLOVITCH Polina

Advisor(s) Email: polina.volovitch@chimieparistech.psl.eu

Research group/Lab: IRCP or IPVF (<https://ipvf.fr/>) or both depending on candidate

Lab location: Paris region (1 h travel by public transport between IRCP and IPVF)

(Lab/Advisor website): <https://sites.google.com/site/volovitchp/home>

Short description of possible research topics for a PhD:

Weight reduction of materials and devices in mobile applications can lead to more than 25 % decrease in total CO₂ emissions. The development of stable lightweight structural materials is hence one of the up to date occupations of material science. Another big challenge for mobile devices lays in a way to produce sustainable energy, including thin layer photovoltaic cells and new rechargeable lightweight batteries. Finally, an important characteristic of the new energy devices relays on a guarantee that their efficiency is stable in time and will not decline in service by material degradation or spontaneous discharge ... The stability of new materials and assemblies is strongly affected by the service conditions, in particular by the presence of electrolytes or humid films and environmental pollutants. The interactions of materials with their environment are composed complex and the environment evolves by itself. A combined multi-disciplinary, multi-scale approach able to describe the evolution of chemical, electrochemical and mechanical state of new materials/ assemblies as a function of time in presence of evolving environments with good time and spatial resolution is necessary, requiring continuous improvement of existing and development of new analytical methodologies. The research in my team is centered around the development of such analytical approaches. The type of the application (structural materials, battery materials or photovoltaic materials) chosen for the PhD will depend on the profile of the candidate.

Required background of the student: Strong background and interest in chemistry (analytical/physical) is necessary. Deep knowledge of material science, electrochemistry and/or instrumentation is a plus but not mandatory.

A list of 5 (max.) representative publications of the group: *see website*