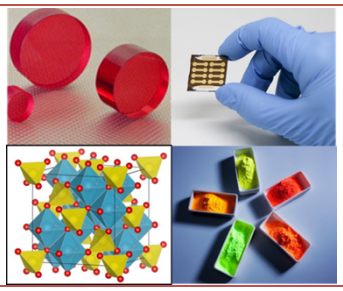
M2 – SMNO-nanomat – CMC

Title:	Condensed Matter Chemistry (CMC)	
	Apogée code: MU5PYM04 **Number of credits:** 3 **Teaching hours:** 26h courses	

Lecturer:	Thierry Gacoin École polytechnique – LPMC thierry.gacoin@polytechnique.edu

Objective	Many scientific and technological discoveries result from important breakthroughs on the development of innovative materials. This can be made possible only by a good understanding of structure-property relationships starting from the fundamental properties of atoms as determined by the nature of their valence orbitals. But other more practical issues, related to materials elaboration, are also a prerequisite for experimental investigation of properties, but also for the implementation of materials into devices. This opens to very important questions regarding the control of extrinsic parameters such as the materials microstructure at various scales, which is known to drastically impact the materials properties. This course is devoted to students having already a general background either in physics or in chemistry. Its objective is to provide the essential knowledge in solid state and materials chemistry. This will allow acquiring appropriate skills useful to apprehend many topics of materials sciences and solid-state physics, taking chemistry issues into account as a link between theory and real life. It will also provide tools to imagine possible modulations of properties by playing with chemistry and to go even further in the development of original compounds.
Content	The course is divided into two parts: **Part 1 – Solid State Chemistry** - The elements and their combinations in solids (electronic structure, valence, bonding in solids, phase diagrams) - Materials structure (ionic model, basic crystalline structures, crystalline sites) - Characterization of materials structure and microstructure (application of powder X-Ray Diffraction) - Crystal field theory and applications to spectroscopy **Part 2 – Materials Chemistry** - Elaboration of materials (special focus on ceramics) - The chemistry of silica (glass, sol-gel, hybrid silicates, silicones) - Surface derivatization chemistry (substrate surface chemistry, silanization, self-assembled monolayers) - Liquid routes to functional coatings (polymers, sol-gel) - Patterned coatings (lithography, soft lithography, embossing) - Nanoparticles (elaboration, functionalization strategies and applications) - Nanostructured coatings (nanocomposite thin films, electrostatic layer by layer deposition, self-organized assemblies)
Prerequisites	This course is opened to any students with a background in general physics and/or chemistry. It is highly recommended for students with a background in physics to complete their education with a chemist vision.
Examination	Written exam