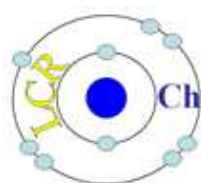




RÉSEAU FRANÇAIS DU FLUOR



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Chimie du fluor



**UMR-CNRS 6296 - Institut de Chimie de Clermont-Ferrand**

**Equipe « Matériaux Inorganiques »**

**Thématique « Fluoration et Matériaux fluorés »**

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**Keywords :** Synthesis, fonctionnalization, fluorine atmosphere, inorganic (nano)fluorides , fluorinated (nano)carbons, energy storage, lubrication, nanocomposites, gas sensors

**Principal Investigators:** Nicolas Batisse, Pierre Bonnet, Daniel Claves, Marc Dubois, Malika El-Ghozzi, [Katia Guérin-Araujo da silva](#), Laurent Jouffret



## Fluorinated materials for energy

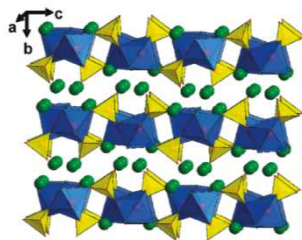
**Aim :** To prepare nanostructured / nanoporous materials for energy through gaseous fluorination processes

**Methods:**

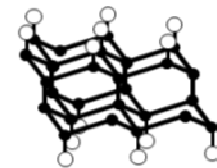
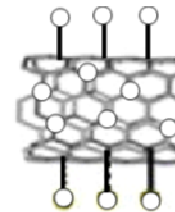
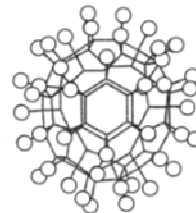
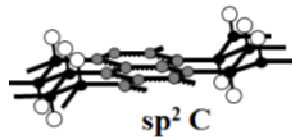
- ✓ Synthesis in fluorinated atmosphere  $F_2(g)$ , anhydrous or aqueous  $HF(aq,g)$ , catalytic atmosphere or using solid fluorinated decomposition ( $TbF_4$ ,  $XeF_2$ , ...)
- ✓ Fluorinated nanocarbons as electrode materials for primary lithium batteries
- ✓ Nanostructured metal fluorides or oxyfluorides as electrode materials for secondary lithium batteries
- ✓ Nanoporous carbide-derived carbons obtained by fluorination and/or chlorination for supercapacitors

**Partners:** SAFT, Centre National d'Etudes Spatiales (CNES), SAFRAN, ORANO (LCR), SYMBIOFCELL, Nanomakers

**Collaboration :** Julien Parmentier, Camélia Ghimbeu, IS2M (Univ. de Haute Alsace), Henri Groult, PESCA (UPMC Paris VI), Nicolas Louvain, Institut Charles Gerhardt Montpellier (Univ. Montpellier), Sandrine Berthon-Fabry (MinesParistech), Patrice Simon, CIRIMAT (Univ. Paul Sabatier), Gary J. Schrobilgen, McMaster University (Hamilton, Ontario), Alain Demourgues, ICMCB (Univ. Bordeaux I), Marian Chatenet, LEPMI (Univ. Grenoble)



$Na_2FePO_4F$



Fluorinated nanocarbons

**Recent publications :** Dalton Transactions, 2018, 47, 4596-4606; J. Electrochem. Soc., 2018, 165, F3346-F3358, J. Power Sources, 2018, 404, 28-38; Catalysis Lett., 2018, 148, 1281-1288; Electrochimica Acta, 2017, 227, 18-23. Electrochimica Acta, 2017, 245, 350-360; J. Alloys and Compounds, 2017, 726, 852-859; Corrosion Engineering Science and Technology, 2017, 52, 611-617.

## Surface Engineering

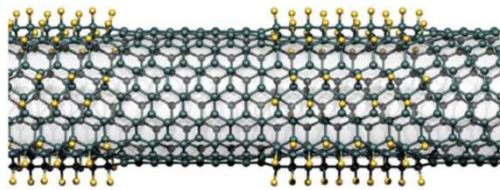
**Aims :** Synthesis and fonctionnalization in fluorinated atmosphere of inorganic (nano)fluorides and fluorinated (nano)carbons for lubrication and nanocomposites (fluorinated nanofillers)

**Method:**

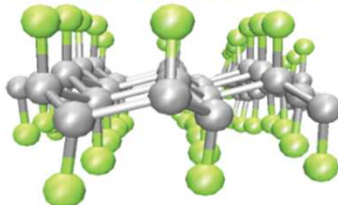
- ✓ New methods for fluorination
- ✓ Fluorination of carbonaceous (nano)materials for tribology
- ✓ Fluorination of graphene, carbon nanotubes, nanofibres and nanodiscs
- ✓ Preparation of fluorinated nanocarbon/polymer composites
- ✓ Surface treatment of polymers to reach multifunctionality (hydrophobicity, gas barrier for CO<sub>2</sub>, O<sub>2</sub> and water, antibacterial, ...)

**Partners:** Valfleurier, GILSON (LABCOM INOMALIS), SOLVAY

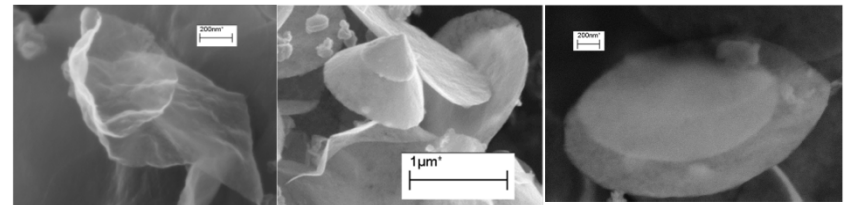
**Collaborations :** Naoki Komatsu, Shiga University Medical Science (Japon), Monica Cracium, Saverio Russo, University of Exeter (UK), Cong Wang, Université de Baihang (Pékin), Alexander Vinogradov, Fock Institute of Physics (State University, St. Petersburg), Jean-Louis Mansot, Philippe Thomas, GTSI (Univ. des Antilles et de la Guyane), Frédéric Guittard, Nice Sophia Antipolis, Jean Yves Mevellec et Jean Luc Duvail, Institut des Matériaux Jean Rouxel (IMN Nantes), Suresh Bhatia, Queensland University (Australia)



Fluorinated SWCNTs (F<sub>2</sub>)



Fluorinated graphene



Graphene materials obtained by fluorination/defluorination processes

**Recent publications :** Comptes Rendus Chimie, 2018, 31, 800-807.; Materials & Design, 2017, 120, 66-74; J. Fluorine Chemistry, 2017, 200, 123-132; Carbon, 2016, 96, 565-577; Surface & Coatings Technology, 2016, 292, 144-154; Progress in Surface Science, 2016, 91, 57-71.