Séminaire

INSTITUT Charles SADRON
CNRS - UNISTRA - STRASBOURG

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Amphithéâtre Henri Benoît

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Chemical Capacitor

the founding ideas and possibility of a new application for conjugated organic polymers

Charge transfer (redox) reactions are often violent and their course cannot be controlled easily, particularly for inorganic systems; they have large equilibrium constants and lead to transfer of an integer number of electrons. Yet, chemical compounds are known which may be nonstoichiometric (e.g. doped) and show intermediate valence of a given chemical element. Many of those have found important applications and some led to technological breakthroughs in the 1900 and 2000s. Conducting organic polymers (both hole- or electron-doped) constitute one important example, while organic charge-transfer salts (e.g. TTF/CA) usually show closer-to-integer values of charge transferred and they sometimes permit the 0/1-type switching between neutral and ionic forms (NIT).

Still, the majority of chemical compounds, especially broad band gap insulators, show a stubborn resistance to electronic doping. Triggered by difficulties in doping of one such system, AgF_2 [1], a new concept of quasi-continuous charge injection has recently been introduced [2]. The “Chemical Capacitor” setup is based on spatial separation of an oxidizer and a reducing agent in nanoscale. It combines certain features of an electrochemical cell, capacitor, n/p junction and FET transistor. A Chem-Cap may actually be prepared [3], but proper design is needed to fully unleash its potential for chemistry and physics. In this talk I will explore some important consequences which this novel nano-device may bring [4]. Special focus will be on a perspective proof of concept of this nano-device utilizing organic polymers and oligomers.

[1] J. Gawraczynski et al., PNAS 116(5): 1495 **2019**.

[2] A. Grzelak et al., Angew. Chem. Int. Ed. Engl., 60(25): 13892 **2021**.

[3] R. Larciprete, et al., Nanoscale 7(29): 12650 **2015**.

[4] D. Jezierski et al., Phys. Chem. Chem. Phys. 24(26): 15705 **2022**.

Les personnes souhaitant rencontrer W. Grochala sont priées de prendre contact avec Marie Pierre Krafft.