CYCLE DE CONFÉRENCES DE CHIMIE

Avec le concours de : **Manufacture Française des Pneumatiques MICHELIN**
SIGMA Clermont
Institut de Chimie de Clermont-Ferrand (ICCF UMR 6296)
U.F.R. de Chimie

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Amphi Rémi

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From MAX to MXene - From 3D to 2D

By now it is well-established that the layered, hexagonal carbides and nitrides with the general formula, $M_{n+1}AX_n$, (MAX) where n = 1 to 3, M is an early transition metal, A is an A-group (mostly IIIA and IVA) element and X is either C and/or N – sometimes referred to as polycrystalline nanolaminates because every basal plane is a potential deformation or delamination plane - combine some of the best attributes of metals and ceramics. They are excellent conductors of heat and electricity, damage and thermal shock tolerant and fracture toughness values as high as 15 MPaVm. Some are lightweight, stiff and have good creep and outstanding oxidation resistance. In 2011 we showed that by simply immersing MAX phase powders, at room temperature, in HF the A-layers are selectively etched to produce 2D materials that we labeled MXenes to emphasize the loss of the A-group element and their similarities to graphene. Currently there are over 20 new compositions with new ones discovered regularly. Unlike hydrophobic graphene, MXenes are hydrophilic and behave as "conductive clays", or 2D metals, a hitherto unknown combination. MXenes such as Ti_2C, V_2C, Nb_2C and Ti_3C_2 can be used as electrode materials in lithium-ion batteries (LIBs) and supercapacitors (SC) as well as transparent conductive electrodes, with performances that are quite impressive. The potential of using MXenes in energy storage, as transparent conductive electrodes, EMI shielding among other applications will be highlighted.

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