SPIC 2022 : Quatrième congrès national Sciences et Technologies des systèmes pi-conjugués
5-8 déc. 2022, Saint Malo 35407 (France)

Propriétés électrochimiques de couche mince ultrastable à base de réseaux métal-organiques générés in-situ par voie électrochimique

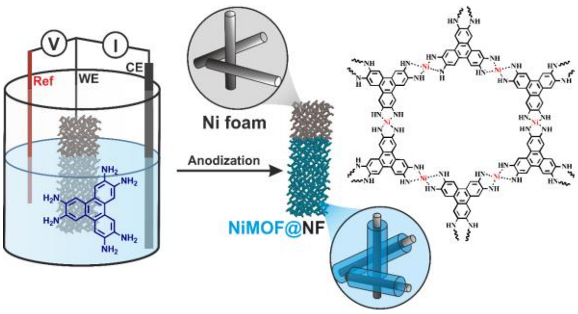
Thuan-Nguyen Pham-Truong*,Hazar Guemiza, Hugo Lavillunière, Cedric Vancaeyzeele and Pierre-Henri Aubert*.

[1] *CY Cergy Paris Université, LPPI, F-95000, Cergy.*
* Email de l'auteur correspondant : thuan-nguyen.pham-truong@cyu.fr

Up-to-date, a great majority of materials for EDLCs devices are mainly composed of carbon-based ones[1,2], e.g. activated carbon, CNTs, and graphene. Even though they possess high theoretical surface area, the experimental capacitance could not reach theoretical values, mainly due to severe problems[3–5], such as π-stacking, short/disordered ion-conduction channels, low packing density, etc. In parallel with the development of new synthetic procedure and/or processing methods using these materials, it is strongly expected to develop novel materials that could also satisfy the two crucial criteria. Indeed, a highly porous, additive-free and thin layer electrode with superior stability could response to all requirements.

In the last decade, metal organic frameworks (MOFs) have widely been investigated in a large range of applications thanks to their large specific surface area (~7,800 $m^2.g^{-1}$ up-to-date[6] and can further reach a theoretical value of ~15,000 $m^2.g^{-1}$)[7] as well as a capability to modulate the physical chemical properties by tuning their structure. Nevertheless, excepting few examples, pristine MOFs are rarely used in supercapacitor application, resulting mainly from their low electrical conductivity (< 10^{-2} $S.cm^{-1}$)[8].

In the present work, the $Ni_3(HITP)_2$ MOF was successfully electrosynthetized via a one-pot approach from and to the surface of nickel foam (NF) and served as ultra-stable thin film electrode (Figure). The presence of the active layer is evidenced by a wide range of technique ranging from morphological, spectroscopic to electrochemical ones. As the film was formed within the diffusion layer of the NF surface, the electrochemical accessible surface area was improved and the drawback of being low electrically conductive of MOF based materials could be minimized. Accordingly, it is confirmed by a significant charge accumulation over dissipation obtained by electrochemical impedance microscopy and a capacitance retention about 40 % from 0.01 to 10 $V.s^{-1}$. Besides, this approach allows the formed materials to be strongly attached to the surface of the current collector, thus significantly enhance the cycling stability around 100 % capacitance retention over 0.9 V for 170,000 cycles.



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