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Study of the influence of synthesis conditions on the electrochemical proprieties of chemically produced polyaniline

The development of energy conversion and storage systems (batteries, fuel cells), electrochemical sensors is essentially based on the development of high-performance and low-cost electrode materials. The high cost of noble metals raises the interest for conductive polymers, which have high electronic and ionic conductivity as well as excellent capacitive properties, making them the materials of choice for the manufacture of electrodes. Among these polymers, polyaniline (PANi) attract a great attention because it has high specific capacity, good electronic properties, good thermal stability and low cost. This polymer is easily synthesized by either chemical or electrochemical methods, leading to the formation of powder or a thin film (hydrogel). The peculiarity of PANi is the ability to switch from a semiconductor state to a conductive state by simple redox or acid-base doping, which improves the electronic transport properties taking into the large variety of dopants introduced into the polymer matrix.

During this PhD project, we focused on the synthesis of polyaniline with suitable electrocatalytic properties. The PANi powder was synthesized by chemical polymerization by varying the experimental parameters such as the concentration of doping agent and the nature of the oxidizing agent, in order to demonstrate the influence of the synthesis conditions on the morphology, physicochemical and electro-catalytic proprieties. The electrocatalytic performance has been evaluated towards the production of H_2. Indeed the electrochemical production of H_2 that is an essential feedstock for industrial processes and energy vector for fuel cell as well as the CO transformation in platform molecules (CO + H_2 = syngas) has unique advantages over the conventional methods based on the thermal catalytic processes operating at high electricity and co-reactants consumption.