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Sirikorn CHASVISED

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SUR LE SUJET SUIVANT :

"Auto-assemblage de copolymères à blocs et application pour électrodes polymères"

JURY :

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Pau, le 06 mai 2021

Le Président et,
Par délégation, la Vice-Présidente de la Commission de la Recherche

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Summary of the thesis :

This thesis is part of the global effort to find alternative energies to those generating CO_2, a greenhouse gas. Indeed, electrodes are herein developed to produce hydrogen from the electrolysis of water. Specifically, block copolymers were developed for use as a binder in ink formulations for electrode screen printing. After presenting a state of the art in the first chapter, we decided to study the effect of microwaves on the self-assembly and the hierarchical structuration of our first polymer binder, a block copolymer (MBM) based on methyl methacrylate (MMA) and butyl acrylate (BuA). The polymer films were annealed under microwave irradiation of 60 seconds at 10 watts. Atomic force microscopy (AFM) was used to study the orientation of the nano-segregation without destruction of the microstructure. Then this MBM copolymer was used as a binder to produce polymer electrodes by screen printing. The MBM is mixed with conductive graphite particles and then printed on the NAFION substrate to produce an electrode. These electrodes were functionalized with a ruthenium catalyst supplied by the group of Prof. Antoni Llobet and were used in the water oxidation process.

We then worked on the synthesis and film structuration of a second block copolymer based on poly (3-hexylthiophene) (P3HT). The conjugated copolymer P3HT-*b*-PMMA was synthesized by coupling reaction *via* "click" chemistry. We demonstrate changes in the self-assembly morphology of the copolymer, by introducing an ionic group at the binding unit between the two blocks. Second, we use microwave annealing to destroy the P3HT fibrils. We observe that after annealing at 30W for 1 minute the fibrils disappear and highly ordered morphologies are successfully created. Finally, we present the synthesis of a new macromolecular catalyst based on P3HT to be integrated into the electrode for the production of hydrogen (reduction of protons). A simple, copper-free cycloaddition process is presented to couple a complex cobalt catalyst (provided by Vincent Artero's group) and the polymer. The electrochemical properties of the P3HT-Co catalyst were characterized by cyclic voltammetry.