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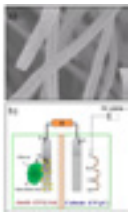
Carbon based materials: A promising approach for water depollution by electrochemical advanced oxidation processes

Marc Cretin
Université de Montpellier, France

Scarcity of pure water worldwide is dramatically affecting the economic development of Third Countries but also the industrial growth of others. Towards the water recycling and reuse, Electrochemical Advanced Oxidation Processes (EAOPs) are of high interest since they are very efficient in the degradation of refractory pollutants that cannot be eliminated by conventional techniques. Amongst them, the electro-Fenton (EF) process allows the in situ generation of highly reactive and nonselective hydroxyl radicals indirectly by cathodic oxygen reduction, its subsequent H_2O_2 production and further Fenton reaction (eq. 1). $Fe_2+ + H_2O_2 + H+ \rightarrow Fe_3+ + \bullet OH + H_2O$ (eq. 1) Carbon felt is a good candidate to produce H_2O_2 from the reduction of dissolved oxygen but it suffers from drawbacks like relatively low electronic conductivity and electrochemical active surface area. With the aim to increase carbon felt efficiency toward the electro-Fenton process, we develop in our research team, different modification routes to get microporous reactive carbon-based structures. It deals from basic thermal treatment under controlled atmosphere to microporous carboneous coating prepared by combining Atomic Layer Deposition and solvothermal MOF growth on carbon felt, going through graphene functionalization and LDH deposition for heterogeneous catalysis. We will discuss synthesis, characterization and electro-catalytic properties of the different structures. Carbon based materials will be then integrated in an electrolysis system for water treatment but also in a prospective fuel cell–Fenton system for zero-energy water depollution. Efficiency will be shown through the degradation and mineralization of pharmaceutical residues and organic dyes.



Biography

Marc Cretin has received his PhD degree in Electrochemistry (National Polytechnic Institute of Grenoble France) in 1996, and joined Geneva University to develop electrochemical sensors for biomedical and environmental analysis. In 1998, he gained a position of Assistant Professor (ENSCM/Montpellier/France) to work on membranes materials for detection, separation and reaction. He's full Professor since 2012 at the University of Montpellier and works mainly in the field of materials for energy and environment. He focuses his research mainly on electroactive materials for fuel cells, biofuel cells, EAOP (electrochemical advanced oxidation processes) and ceramic membranes for water treatment. He is currently the Director of the Department of Physico-Chemistry, Interface and Polymer at the European Membrane Institute of Montpellier (IEM) and Co-Director of the International French-Russia Laboratory MEIPA Ion Exchange Membranes and Associated Processes. Up to March 2017, he has co-authored more than 80 peer reviewed papers.

marc.cretin@umontpellier.fr

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