Characterization and Photoelectrocatalytic Evaluation of MOF-235 Films Obtained by the Solvothermal Synthesis

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Metal-Organic Framework (MOF) is a new class of materials that has had the attention of researchers in the last years. They are structurally based on the presence of a metal ion or clusters linked by an organic ligand in a highly ordered structure, giving rise to materials with pronounced properties [1]. Its main characteristics are its versatility and excellent physical-chemical properties, such as a high adsorption capacity, gas storage, catalytic activity, and semiconductor behavior [1,2]. MOF-235 stands out among the thousands of different MOFs, since orange crystals are formed in an octahedral structure, and each trivalent iron atom is organized by the organic terephthalic acid ligand [2]. In this work, the MOF-235 was obtained by solvothermal synthesis (a simple and fast process), and the electrode's photoelectrochemical properties were evaluated (5, 10, and 15 layers). The physical-chemical characterization of the material by XRD and FTIR techniques confirmed the desired structure, and the SEM images confirm its morphology (hexagonal bipyramid). Besides, the diffuse reflectance spectroscopy technique was important to estimate the band gap energy of this material (~2.00 eV). Considering the photoelectrochemical characterization, it was verified that the MOF-235 presents n-type semiconductor behavior, and the electrodes with the lowest number of layers present the best photoelectrochemical response. This result may be related to the greater absorption of the incident light (visible light), in addition to the thickness and homogeneity of the material on the substrate surface. With a smaller thickness, the photoexcited electrons formed on the MOF surface can more easily migrate to the substrate (ITO) and, later, to the auxiliary electrode, decreasing the charge carriers' recombination (e^-/h^+).

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References:

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