Bismuth oxychloride (BiOCl) is a p-type semiconductor material that has been investigated in recent years due to its unique properties. The packaging layers of -[Cl-Bi-O-Bi-Cl]- provides the formation of an internal static electric field that facilitates the separation of photogenerated charge carriers, minimizing the recombination processes of the electron/hole pairs. This inherent property leads this material to be applied as electrode materials in photoelectrochemical systems [1,2]. In this work, the FTO/BiOCl electrode was constructed by a simple, fast, low cost and efficient SILAR deposition process and the photoelectrochemical production of N\textsubscript{2}H\textsubscript{3} via dinitrogen fixation was realized as an alternative to the Haber-Bosh process’s ammonia synthesis. By the x-ray diffraction, all the diffracted peaks are in agreeing to the tetragonal structure (JCPDS 06-0249). Scanning electron microscopy topographic image of the FTO/BiOCl electrode shows a homogeneous micro-aggregate distribution. Besides, the micro-aggregate with the spherical shape is formed up of small particles with an elongated format. The N\textsubscript{2} physisorption analysis indicates a large specific area of 12.5 m\textsuperscript{2} g\textsuperscript{-1}. The voltammetry analysis indicated greater activity for the nitrogen reduction reaction (NRR) compared to the hydrogen reduction reaction (HRR), in addition to a high yield of N\textsubscript{2}H\textsubscript{3} 12.6 µg h\textsuperscript{-1} cm\textsuperscript{-2} and Faradaic efficiency greater than 26.7 % at - 0.2 V vs. RHE in ambient conditions (0.1 mol L\textsuperscript{-1} Na\textsubscript{2}SO\textsubscript{4} electrolyte). It is believed that the good results of FTO/BiOCl during NRR are related to a high specific area, making available active sites. The material homogeneity in the electrode and the excellent visible light absorption were also decisive factors for the supply of high-energy electrons necessary for ammonia production.

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References: