Water Oxidation Catalysis by Molybdenum-doped Manganese Oxide

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Designing a high efficient, cheap and green water oxidation catalyst (WOC) is one of the most important challenges in the sustainable energy field. The $CaMn_4O_5$ cluster in nature's photosystem II catalyzes photosynthetic splitting of water into oxygen and protons.[1] Therefore, many researchers focus on modelling this metalloenzyme center by metal complexes with different ligands, as well as through various metal oxides.[2] According to undeniable role of manganese in the natural water oxidation reaction, manganese oxides are promising as environmentally friendly catalysts.[2] Their optimization is a sustainable way to robust materials for applications. In this work, molybdenum doped manganese oxide was synthesized and characterized by PXRD, XPS, TGA, FT-IR, Raman, BET, SEM, and HRTEM. In addition, the catalytic activity of doped molybdenum manganese oxide in chemical, photochemical and electrochemical water oxidation reactions are investigated. Results show that molybdenum has a significant effect on the chemical activity of manganese oxide in ceria solution. The water oxidation experiment under the photochemical conditions with Mo doped Mn_2O_3/$[Ru(bpy)_3]^{2+}$/$S_2O_8^{2-}$ also led to promising results (TOF ~0.83 µmol $O_2.m^{-2}.s^{-1}$).

[1] Yasufumi Umena, Kawakami Keisuke, et al. *Nature*, **2011**, 473, 55-60.
[2] Mohammad Mahdi Najafpour, Renger Gernot, et al. *Chem. Rev.,* **2016** 116, 2886-2936.