Giant magneto-electrocatalytic effect in Ni-based electrodes

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Alkaline water electrolysis represents one of the simplest methods employed for renewable hydrogen production [1]. In contrast to acidic electrolyzers (e.g., PEM), alkaline electrolyzers reach high conversion efficiency with low-cost abundant transition metals such as Ni-Fe alloys [2]. In addition to its intrinsically high electrolytic activity for oxygen evolution reaction (OER), we show that the activity can be enhanced by more than 20% simply applying a magnetic field (Fig. 1). The understanding of the phenomenon is complex as the surface of these catalysts is subject to a dynamic equilibrium, and the presence of specific phases depends on the presently applied conditions including the magnetic field as well as on the history of the sample. Using APXPS [3] and a combination of soft- and hard x-ray photoelectron spectroscopy with electrochemical impedance spectroscopy we find that the high intrinsic electronic conductivity comes together with an increasing water intercalation into the oxy-hydroxide, which is experimental evidence for a water mediated OH- diffusion mechanism. Our hypothesis is that this pore structure is affected by the presence of a magnetic field to minimize the local stray field. The (re-)orientation requires restructuring of the surface, explaining the time dependence of the effect.

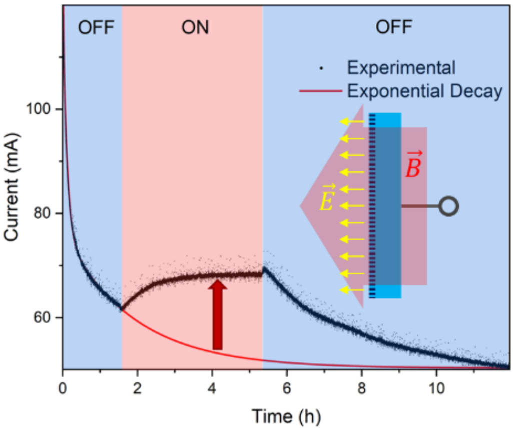

Fig. 1. OER enhancement of Ni-based electrode under applied magnetic field.

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