Electrochemical water splitting with functionalised Ni foam electrodes

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Electrochemical water splitting is considered one of the most efficient and reliable approaches to produce hydrogen from renewable energy. Solar water splitting, in particular, can be a promising alternative to the CO_2-emitting fossil fuel based energy systems, although the cost of photovoltaic-electrochemical systems is still high compared to conventional carbon based methods for Hydrogen production. Alkaline water electrolysis can allow low cost because it can use non-precious catalysts. However, direct coupling of electrolysis and photovoltaic cells in an integrated system implies the operation at room temperature and at low current density. On the contrary, electrolysis cells are usually optimized for operating at about 80 °C and the general aim is to obtain high power densities in very compact stacks. In order to achieve high electrolyser efficiency (>75 %) at ambient temperature, without large cost increase, electrode material with high catalytic activity becomes crucial and suitable setups need to be identified. In this paper we present an electrochemical system optimised for operation at room temperature, based on alkaline electrolysis and Ni foam electrodes. Nanocatalysts have been deposited on the Ni surface by spontaneous galvanic displacement. The deposition conditions, as well as the catalyst amount have been optimized in order to improve not only the catalytic activity, but also the stability. The performance has been evaluated by using KOH 1 M electrolyte solution for operation at room temperature (22 °C).