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Transducing Energy Loss in Water Electrolysis with a 0D Ion-Sensitive Field-Effect Transistor NICOLAS CLEMENT, IEMN-CNRS (France), KATSUHIKO NISHIGUCHI, NTT Basic Research Labs (Japan), JEAN-FRANÇOIS DUFRÊCHE, CEA-Marcoules (France), DAVID GUÉRIN, IEMN-CNRS (France), GILLES PATRIARCHE, LPN-CNRS (France), DAVID TROADEC, IEMN-CNRS (France), AKIRA FUJIWARA, NTT Basic Research Labs (Japan), DOMINIQUE VUILLAUME, IEMN-CNRS (France) — In order to produce hydrogen as a fuel source of the future, water electrolysis is one of the most "promising" green approaches. Although electrolysis efficiency can be as high as 80%, it still means that at least 20% of the energy is lost. The use of transducers to collect the energy loss in water electrolysis is attractive. Among the various transducers, several ideas have been proposed such as an air bubble powered rotary driving apparatus or a microcantilever vibrating after impact of each bubble. However, the main source of energy lost appears at electrode interfaces with the presence of a double layer of ions acting as a resistor and capacitor. In this study, we show that using a 0D – ultra low noise - ISFET, allows getting the energy coming from the double layer fluctuation at each H2 bubble emission. Interestingly, the output signal that can be tuned with salt concentration and electrolysis current exactly corresponds to that of action potential which could be useful for bio-applications . In addition, electrical detection of bubbles emission at single bubble level also opens the door to optimization of hydrolysis efficiency and further save energy for hydrogen production.

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