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The Scanning Vibrating Electrode Technique (SVET) as a Tool for Optimising a Printed Ni(OH)2 Electrode under Charge Conditions

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Abstract : The aim of the current study is to optimise formulations, in terms of charging efficiency, of a printed Ni(OH)2 precursor coating of a battery anode. Through the assessment of the current densities during charging, the efficiency of a range of formulations are compared. The Scanning vibrating electrode technique (SVET) is used extensively in the field of corrosion to measure area-averaged current densities of freely-corroding metal surfaces when fully immersed in electrolyte. Here, a Ni(OH)2 electrode is immersed in potassium hydroxide (30% w/v solution) electrolyte and charged using a range of applied currents. Samples are prepared whereby multiple coatings are applied to one substrate, separated by a non-conducting barrier, and charged using a constant current. With a known applied external current, electrode efficiencies can be calculated based on the current density outputs measured using SVET. When fully charged, a green Ni(OH)2 is oxidised to a black NiOOH surface. Distinct regions displaying high current density, and hence a faster oxidising reaction rate, are located using the SVET. This is confirmed by a darkening of the region upon transition to NiOOH. SVET is a highly effective tool for assessing homogeneity of electrodes during charge/discharge. This could prove particularly useful for electrodes where there are no visible surface appearance changes. Furthermore, a scanning Kelvin probe technique, traditionally used to assess underfilm delamination of organic coatings for the protection of metallic surfaces, is employed to study the change in phase of oxides, pre and post charging.

Keywords : battery, electrode, nickel hydroxide, SVET, printed
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