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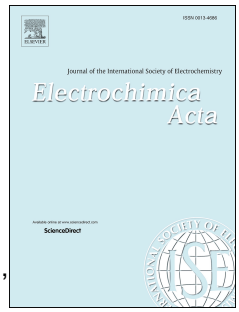

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Electrochemical Analysis and Mixed Potentials Theory of Ionic Liquid Based Metal–Air Batteries with Al/Si Alloy Anodes

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Abstract: Aluminium and silicon, when coupled with an air cathode in an electrochemical cell may provide theoretical specific energies of up to 8146 mWh/g and 8470 mWh/g. Proof of concept for the discharge in cells with ionic liquid EMIm$(HF)_{2.3}$F electrolyte had been established in 2009 for silicon and in 2015 for aluminium. The objective of the present work is the investigation of discharge behavior and corrosion in this type of cell using binary Al/Si alloys as anodes. Al/Si alloys with nine different compositions were prepared by an arc melting process and shaped to anodes. Microstructure of the anodes in the initial state was evaluated with respect to the fractions of its constituents. Al/Si–air primary full cells were investigated with respect to voltages during OCV and discharge during intermediate term (20 h) runs under current densities of 250 µA/cm^2. Voltages decrease with Si-content in the alloys following trends with quantitatively different characteristics for the hypoeutectic, intermediate hypereutectic and the alloys with high Si content. SEM analysis of surface