Contact of Lithium Metal-Separator-Cathode in a Li-Battery

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ABSTRACT

The use of Li metal electrodes would greatly increase the energy density of rechargeable Li batteries, but formation of complex Li metal structures (referred to as "dendrites") on the metal surfaces leads to battery failure, which has precluded their use. Recent experiments suggest that these dendrites can be suppressed when pressure is applied to the Li electrode, but there are no measurements or calculations to estimate what pressures are actually generated. This presentation reports a semi-analytical method (SAM) based three-dimensional (3D) contact model, for trackling the mechanical behaviors of realistic anode-separator-cathode interfaces in a Li metal battery, in which: (1) both the Li-anode and cathode surfaces are rough; and (2) both the Li-anode and separator are treated as deformable materials under contact. The proposed model is implemented to analyze the influences of separator thickness, electrode roughness, material properties on the contact stresses of the Li electrode.

Keywords: contact stress; lithium battery; energy density; rough electrode; electrode-separator interface.