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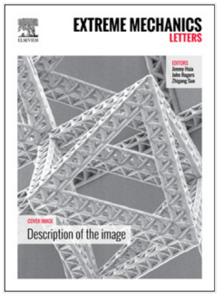


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# Flexible Batteries Under Extreme Bending: Interfacial Contact Pressure and Conductance

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**Abstract**

Advances in flexible electronics, including touch-screens and wearable sensors, have created a high demand for flexible energy storage devices. Flexible polymer-based lithium ion batteries are the leading candidates to offer safety and mechanical advantages; however, their performance and properties under bending are not fully understood. In this study, we experimentally and theoretically investigate the effects of extreme mechanical bending on the interfacial properties of the battery including contact pressure and conductance. Our results show that bending and contact properties significantly influence the interfacial contact pressure, which can be related to the battery conductance. We compare the developed theoretical model to the mechanical bending tests performed on a flexible battery fabricated in our laboratory. The test results are correlated with the battery impedance measurements at various bending curvatures. The numerical and experimental results show good agreement, and demonstrate the potential applicability of the developed analytical model to interpret and predict the variation of battery conductance with bending deformation.

## 1. Introduction

Emerging technologies in recent years, including flexible, implantable and wearable electronics, have led to an increased demand for flexible energy storage devices. Flexible lithium ion batteries (LIBs) are an ideal choice given their high energy density and high efficiency. Flexible LIBs based on solid polymer electrolyte (SPE) can offer greater safety and chemical stability, and due to their superior mechanical properties, they are capable of withstanding high deformation while resisting fracture, making them well suited for flexible electronics applications.