

Communication

## A Stable Quasi-Solid-State Sodium-Sulfur Battery

Dong Zhou<sup>a</sup>, Yi Chen<sup>a</sup>, Baohua Li<sup>b\*</sup>, Hongbo Fan<sup>c</sup>, Faliang Cheng<sup>c</sup>, Devaraj Shanmukaraj<sup>d</sup>, Teofilo Rojo<sup>d</sup>, Michel Armand<sup>d\*</sup> and Guoxiu Wang<sup>a\*</sup>

- [a] Dr. D. Zhou, Y. Chen, Prof. G. Wang  
Centre for Clean Energy Technology, School of  
Mathematical and Physical Sciences  
University of Technology Sydney  
Sydney, NSW 2007 (Australia)  
E-mail: Guoxiu.Wang@uts.edu.au
- [b] Prof. B. Li  
Graduate School at Shenzhen  
Tsinghua University  
Shenzhen, Guangdong 518055 (China)  
E-mail: libh@mail.sz.tsinghua.edu.cn
- [c] Prof. H. Fan, Prof. F. Cheng  
School of Materials Science and Engineering  
Dongguan University of Technology  
Dongguan, Guangdong 523106 (China)
- [d] Dr. D. Shanmukaraj, Prof. T. Rojo, Prof. M. Armand  
CIC-ENERGIGUNE  
Parque Tecnológico de Alava  
Miñano 01510 (Spain)  
E-mail: amarmand@cienergigune.com  
Supporting Information for this article is given via a link at  
the end of the document.

## Abstract

Ambient-temperature sodium-sulfur (Na-S) batteries are considered a promising energy storage system due to high theoretical energy density and low cost. However, great challenges remain in achieving high rechargeable capacity and long cycle life. Herein we report a stable quasi-solid-state Na-S battery enabled by a poly(S-pentaerythritol tetraacrylate (PETEA))-based cathode and a (PETEA-tris[2-(acryloyloxy)ethyl] isocyanurate (THEICTA))-based gel polymer electrolyte. The polymeric sulfur electrode strongly anchors sulfur via chemical binding and inhibits the shuttle effect. Meanwhile, the in-situ formed polymer electrolyte with high ionic conductivity and enhanced safety successfully stabilizes the Na anode/electrolyte interface, and simultaneously immobilizes soluble Na polysulfides. The as-developed quasi-solid-state Na-S cells exhibit a high reversible capacity of 877 mA h g<sup>-1</sup> at 0.1 C and an extended cycling stability.