

# A Dual-Stimuli-Responsive Sodium Bromine Battery with Ultra-High Energy Density

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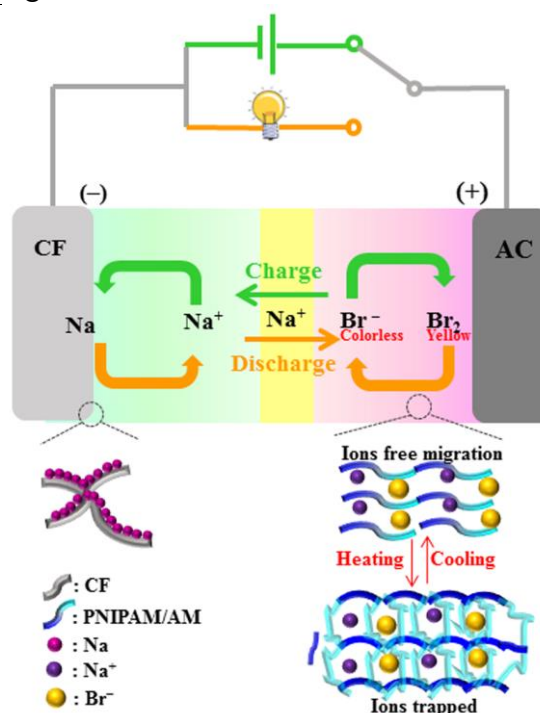
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Stimuli-responsive energy storage devices have emerged for the fast-growing popularity of intelligent electronics. However, all previously reported stimuli-responsive energy storage devices have rather low energy densities ( $<250 \text{ Wh kg}^{-1}$ ) and single stimuli-response, which seriously limit their application scopes in intelligent electronics.<sup>[1]</sup> We demonstrate a dual-stimuli-responsive sodium-bromine (Na//Br<sub>2</sub>) battery featuring ultra-high energy density, electrochromic effect and fast thermal response. Na dendrites in the negative electrode of the Na//Br<sub>2</sub> battery during charge/discharge cycling was effectively suppressed by directing its growth along carbon fibres. Remarkably, the fabricated Na//Br<sub>2</sub> battery exhibits a large operating voltage of 3.3 V and an energy density up to  $760 \text{ Wh kg}^{-1}$ , which outperforms those for the state-of-the-art stimuli-responsive electrochemical energy storage devices.<sup>[2]</sup> This work offers a promising approach for designing multi-stimuli-responsive and high-energy rechargeable batteries without sacrificing the electrochemical performance.

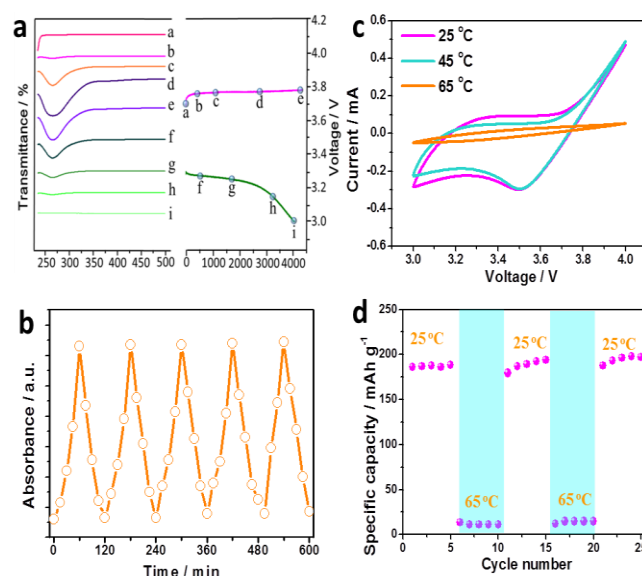
## References

- [1] P. Zhang, F. Zhu, F. Wang, J. Wang, R. Dong, X. Zhuang, O. G. Schmidt, X. Feng, *Adv. Mater.* 29 (2017) 1604491.  
 [2] F. Wang, H. Yang, J. Zhang, P. Zhang, G. Wang, X. Zhuang, G. Cuniberti, X. Feng, *Adv. Mater.* 2018 (accepted).

## Figures



**Figure 1:** Schematic illustration of the assembled Na//Br<sub>2</sub> battery



**Figure 2:** The reversible (a,b) electrochromic and (c,d) thermo-responsive properties of the Na//Br<sub>2</sub> battery