Ultra-High Phosphorus-Doped Wood-Derived Carbon Enabling High-Energy Density and Long-Cycling for Supercapacitor

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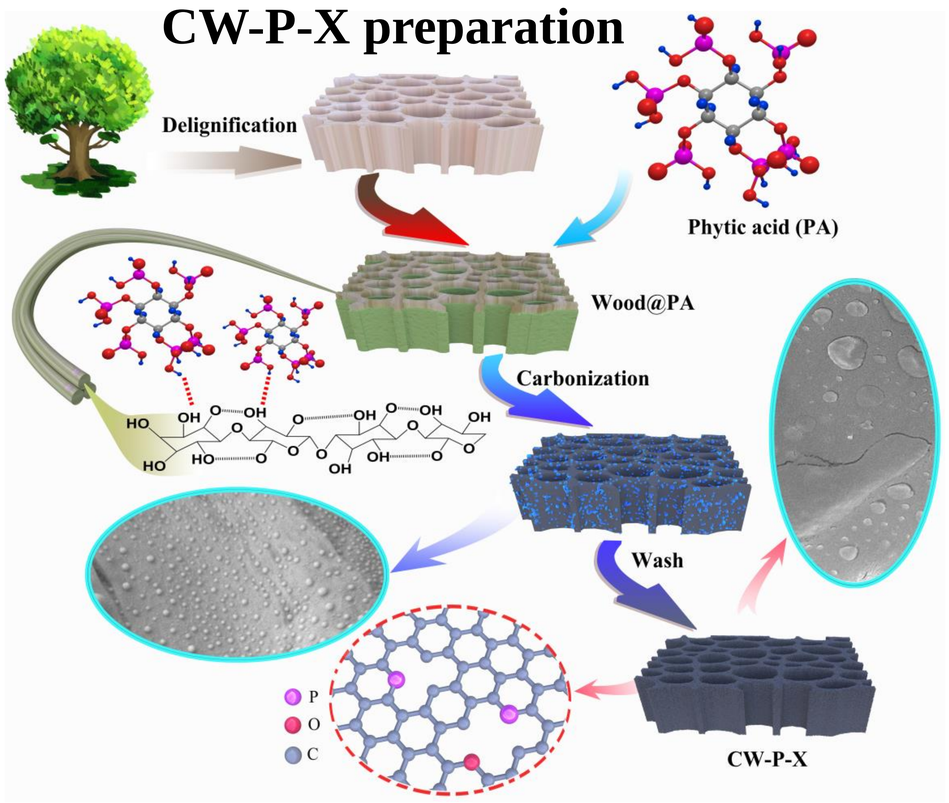
Aim and Motivation

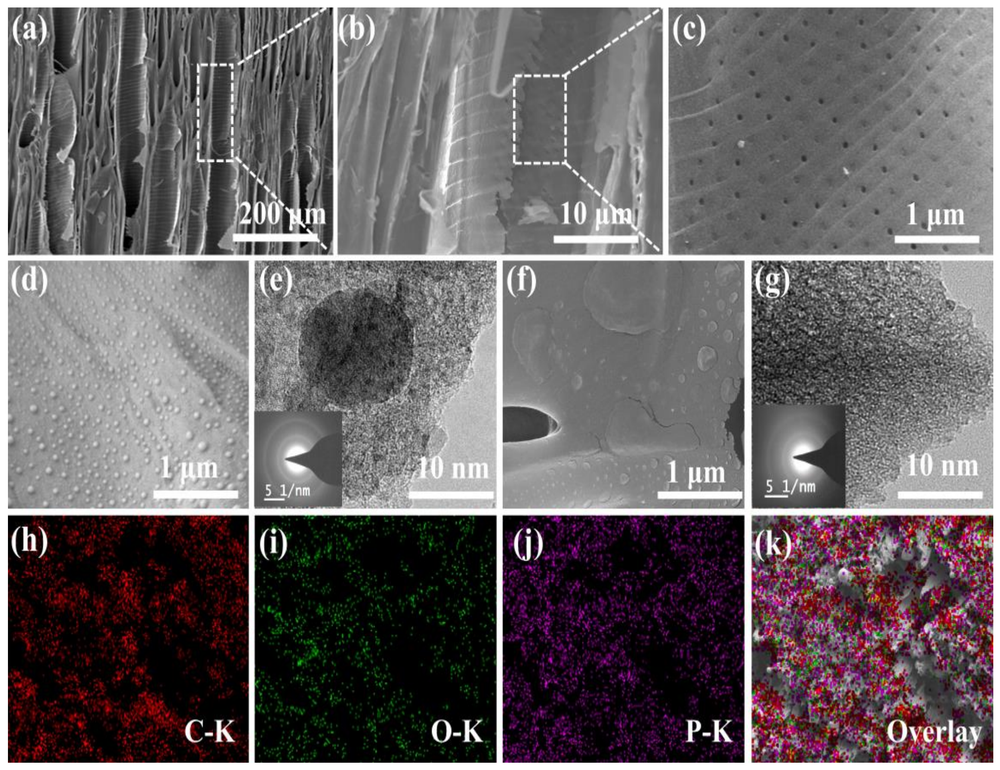
Wood and its derivatives as electrode materials are mainly suffered by sluggish electrochemical activity and unsatisfied energy density. Hence, we report an ultrahigh phosphorus-doped wood-derived carbon for supercapacitor via phytic acid, which can generate hydrogen bond with cellulose molecules in the wood. The content of phosphorus reaches up to 9.24 at% in carbonized wood with P-doped (CW-P-9.24), higher than most previously reported phosphorous-doped carbonaceous materials. CW-P electrode exhibits greatly improved electrochemical performance, especially in energy density and cyclic stability. These results make CW-P electrode promising for practical application in energy storage devices and encourage more investigations for electrochemical storage.



◆ **Hierarchical structure**

◆ **Highly uniform P-doping**

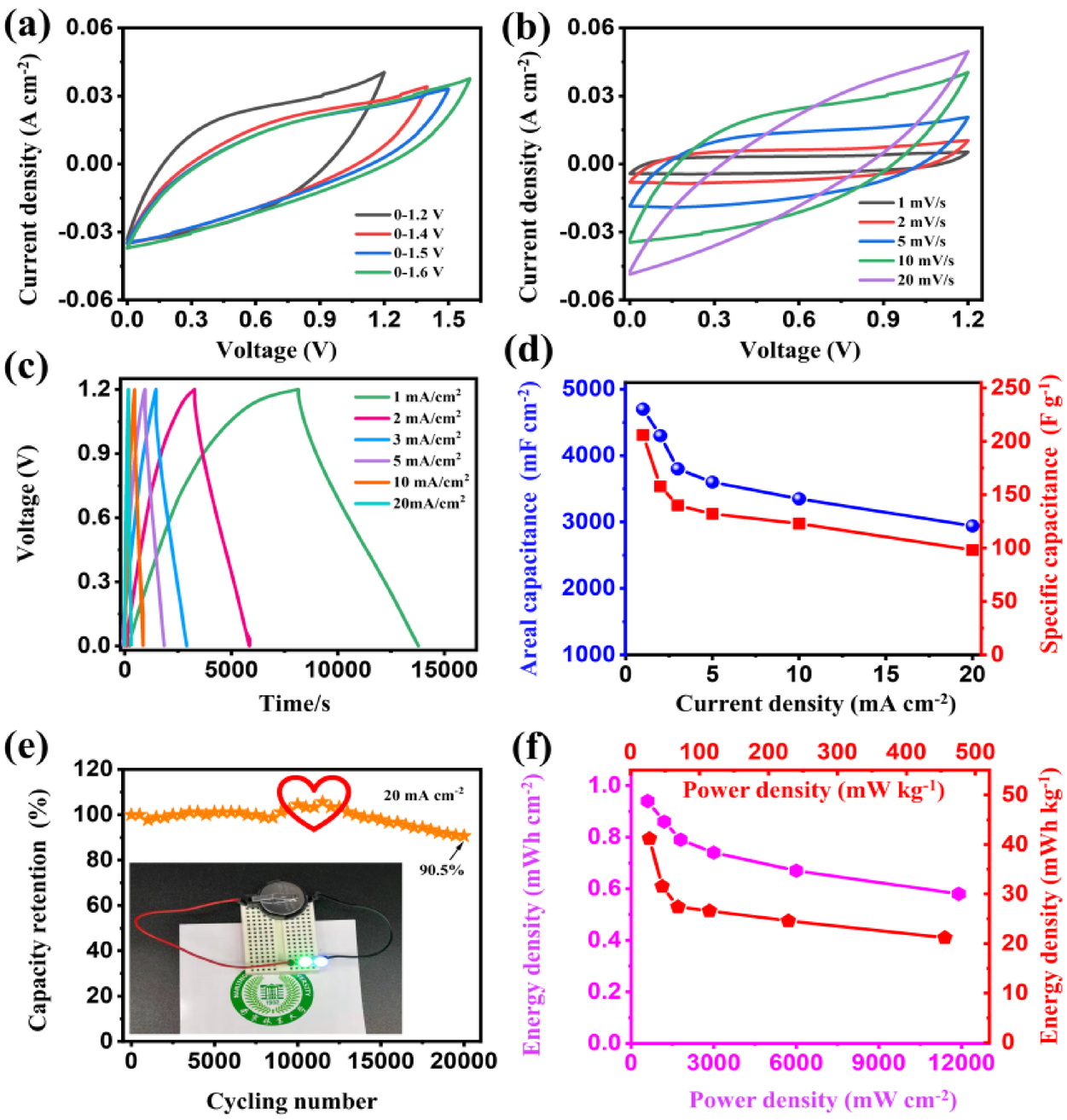
◆ **Fast electrolyte transfer channel**



Electrochemical performance

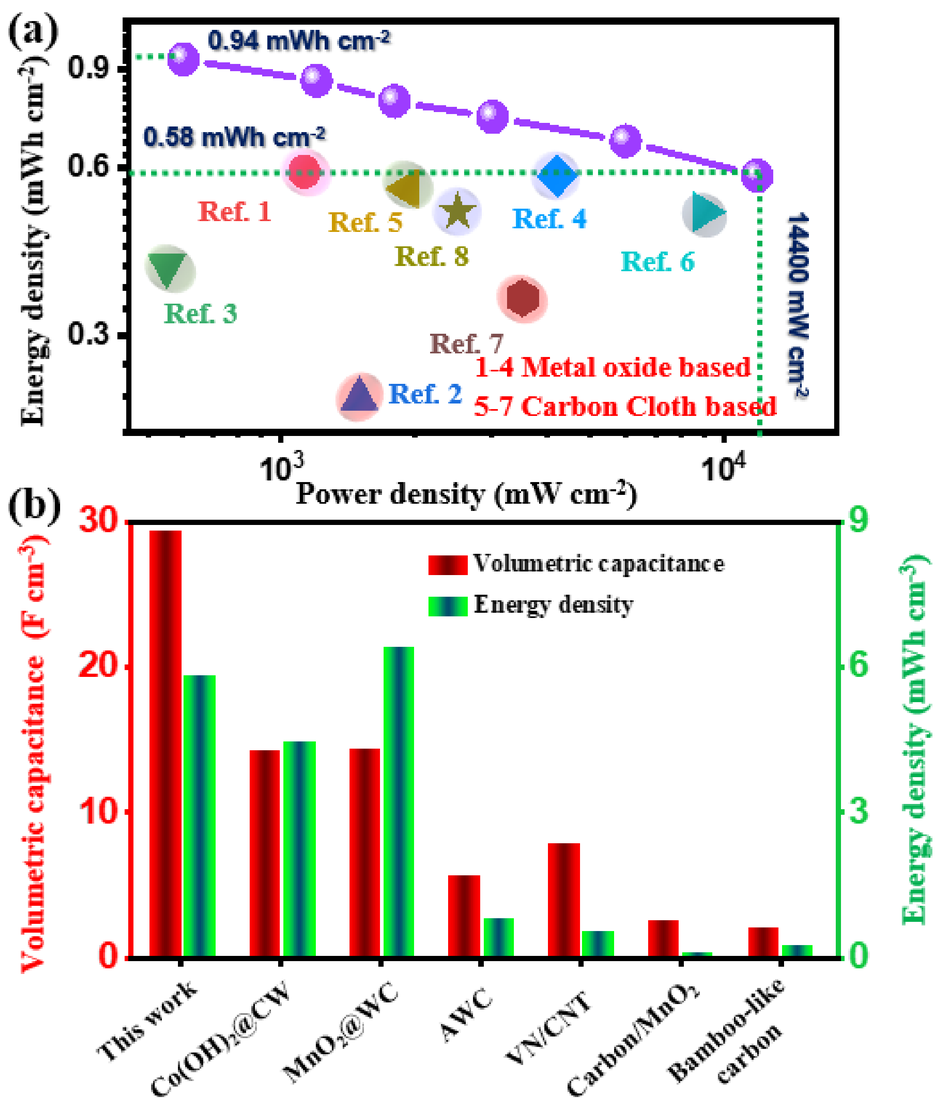
◆ **Two-electrode system**
◆ **Ultra-high P-doping ~9.24 at%**

◆ **Extraordinary cycle stability:**
12000 cycles with 104%
20000 cycles with 90.5%



Comparison device parameter

◆ **Volumetric capacitance: 29.3 F cm^{-3}**
◆ **Energy density:0.94 mWh cm^{-2} and power density 14400 mW cm^{-2}**



Conclusions

- **Ultra-high P-doping ~9.24 at% and excellent cyclic stability ~20000/90.5%.**
- **High energy and power density with high volumetric capacitance.**
- **The method can be extended to lithium ion battery and zinc air battery.**

Acknowledgement

NSFC National Natural Science Foundation of China
Nanjing Forestry University
Wuhan University of Technology 武漢理工大學
NSFJ Natural Science Foundation of Jiangsu Province
mit media lab
KAIST Korea Advanced Institute of Science and Technology