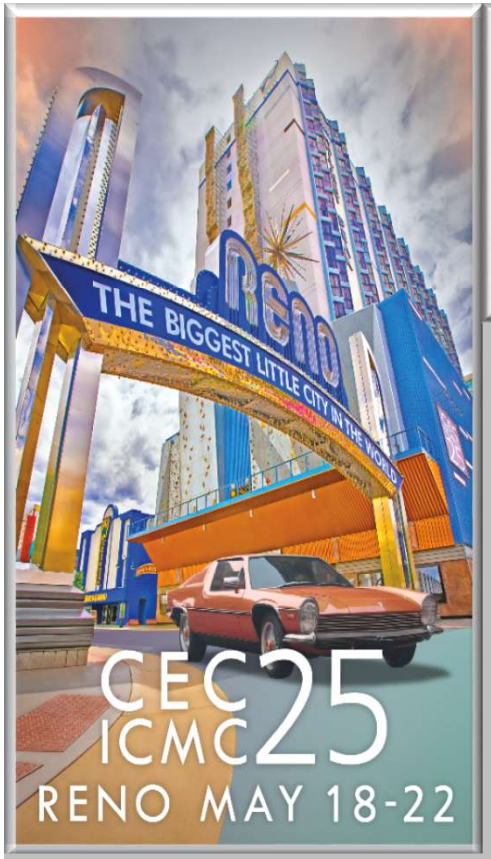


Formation of thermal conductive hydrogel network in boron nitride/polyvinyl alcohol by directional freezing assisted salting-out method for cryogenic application

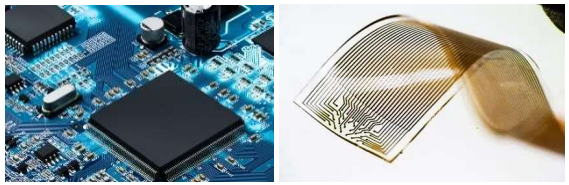
ID:343

Zhao Junting[1,2], Zhou Zhengrong[1,3], Wang Tao[1], Huang Rongjin[1,2,*], Zhang Hongwei[1], Miao Zhicong[1]

[1] Key Laboratory of Cryogenic Science and Technology, Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing 100190, PR China;
[2] Center of Materials Science and Optoelectronics Engineering, University of Chinese Academy of Sciences, Beijing 100049, PR China;
[3] Hunan Key Laboratory of High-Performance Intelligent Sensor and Detection System , The 48th Research Institute of CETC, Changsha, China;

zhaojunting23@mails.ucas.ac.cn

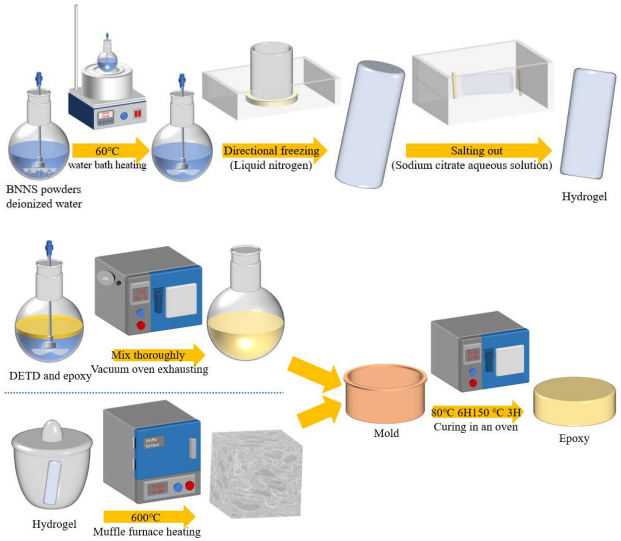
1. Introduction:



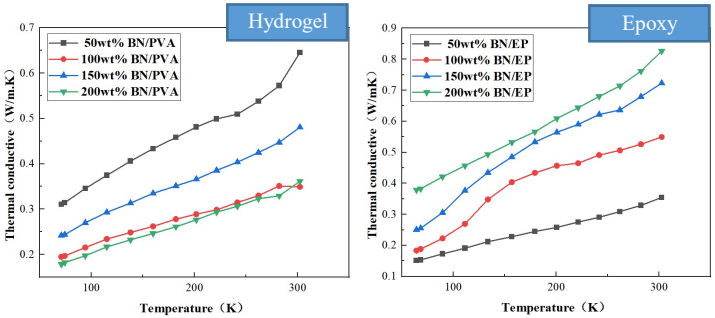
- Electronic components are developing in the directions of miniaturization, integration and flexibility.
- Due to good flexibility, hydrogel-based materials has attracted extensive attention.
- The hydrogel materials prepared by conventional methods have poor performance, especially in mechanical properties and thermal conductivity aspect.
- In this research, we adopted the method to prepare composite materials with high mechanical and thermal properties.

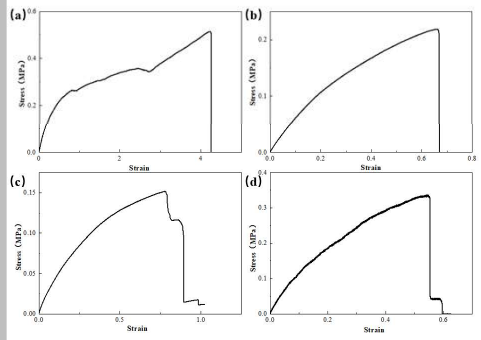
2. Methods:

- **Preparation of BN/PVA composite hydrogel**
  - PVA and BN were mixed in a certain proportion through water bath heating, poured into a mold for directional freezing, and then salting out was performed to obtain a hydrogel.
- **Preparation of 3D-BN/epoxy composite**
  - Sintered hydrogels were used to obtain porous BN skeletons. The BN skeletons were immersed in the resin mixture, vacuum degassed and then cured to obtain BN/ epoxy nanocomposites.
- **Characterization**
  - Scanning electron microscopy (SEM).
  - UTM6503 electronic universal testing machine.
  - CTM-60K model of the steady-state thermal conductivity tester.



3. Discussion:





- The thermal conductivity of PVA/BN composites range from 0.35–0.65 W/m·K at 300 K, 0.17-0.32 W/m·K at 77 K.
- The thermal conductivity of epoxy composites range from 0.35 to 0.83 W/m·K at 300 K, 0.15-0.38 W/m·K at 77 K.
- The tensile strength of hydrogel can reach 513.4 kPa, and the elongation at break can reach 426.53%.

4. Conclusion:

- The thermal conductivity of hydrogel composites increase by more than 260% compared with pure PVA hydrogels.
- The tensile strength of the hydrogel composite is in the range of 151.7-513.4 kPa, and the overall mechanical strength is good.
- The hydrogel sintered at high temperature can be used to prepare a 3D thermal conductivity network, and the thermal conductivity of the material prepared by impregnating it in epoxy resin can reach 0.83 W/m·K.