Sustainable Paper Templated Ultrathin, Light-Weight And Flexible Niobium Carbide Based Films Against Electromagnetic Pollution

Xingmin Liu, Wenjie Xie, Ralf Riedel, Anke Weidenkaff

Department of Materials Science, Technical University of Darmstadt, D-64287 Darmstadt, Germany

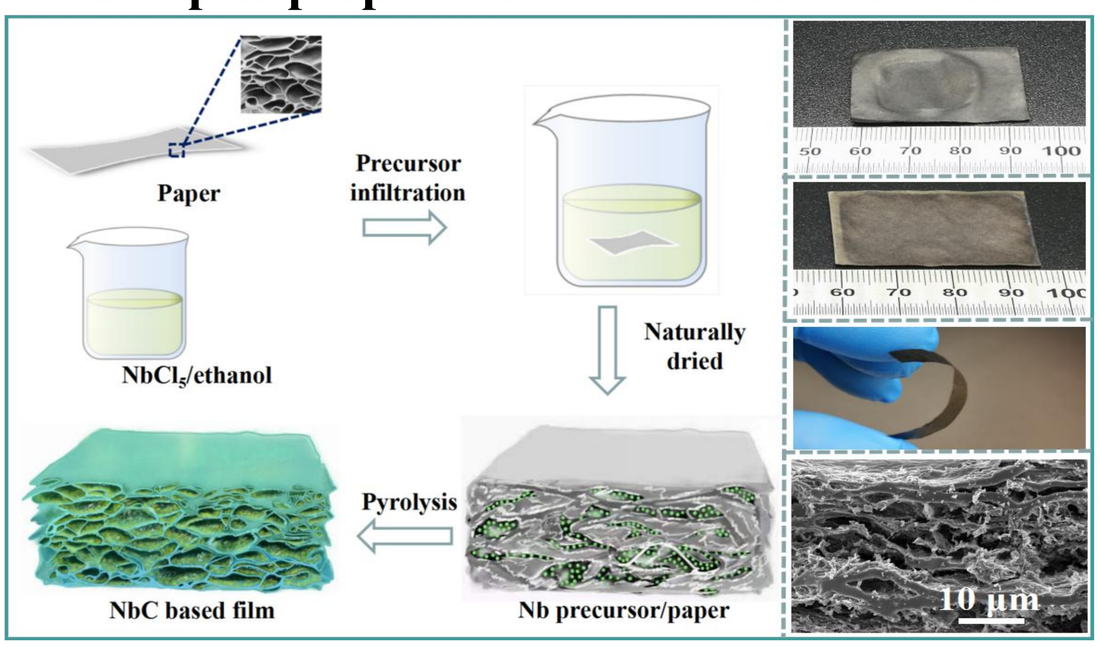
Motivation

- Preparation of advanced NbC-based free standing film for electromagnetic interference shielding by employing the intrinsic property of NbC.
- To explore more eco-friendly and commercially effective route for the recycling of used paper through developing their application in the electromagnetic field.

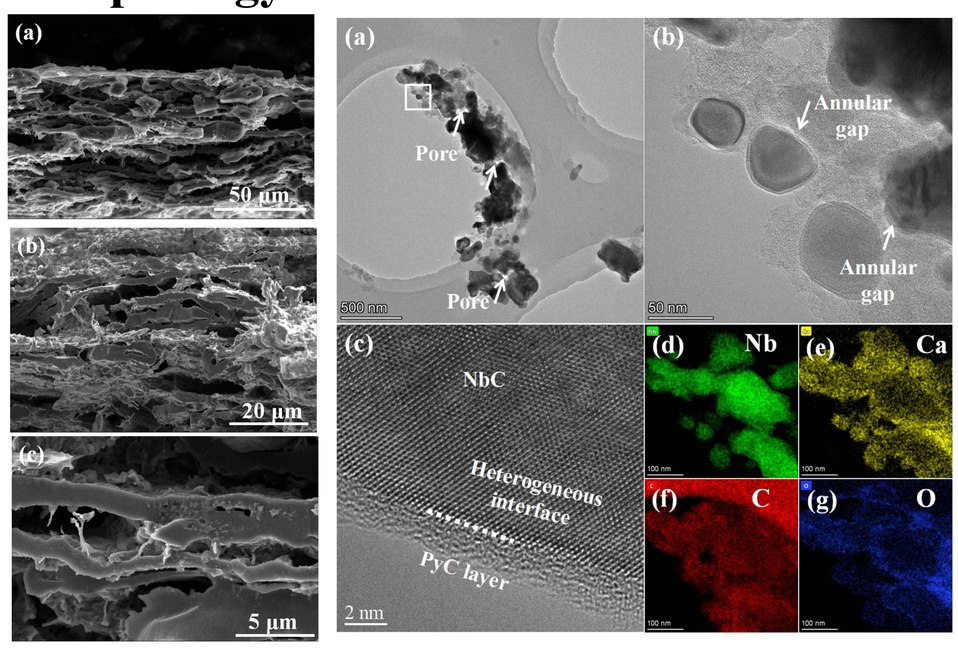
Experiment

- Paper templated precursor infiltration and pyrolysis process.
- The relative complex permittivity was obtained by waveguide method using a vector network analyzer (VAN, MS4644A; Anritsu, USA) in the frequency of 8.2~12.4 GHz

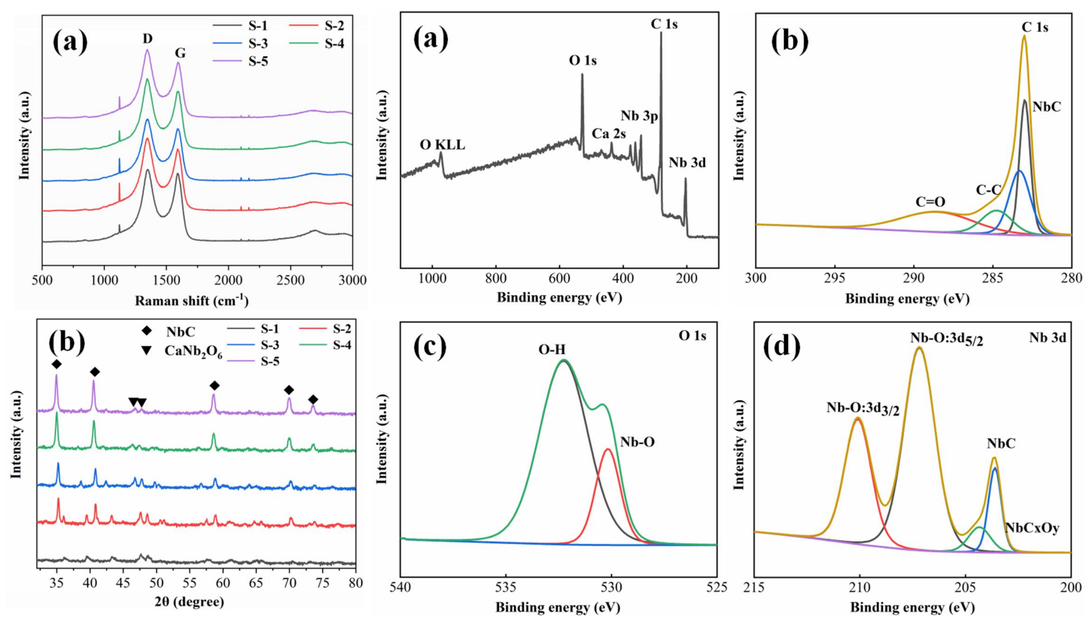
Samples preparation and the control model



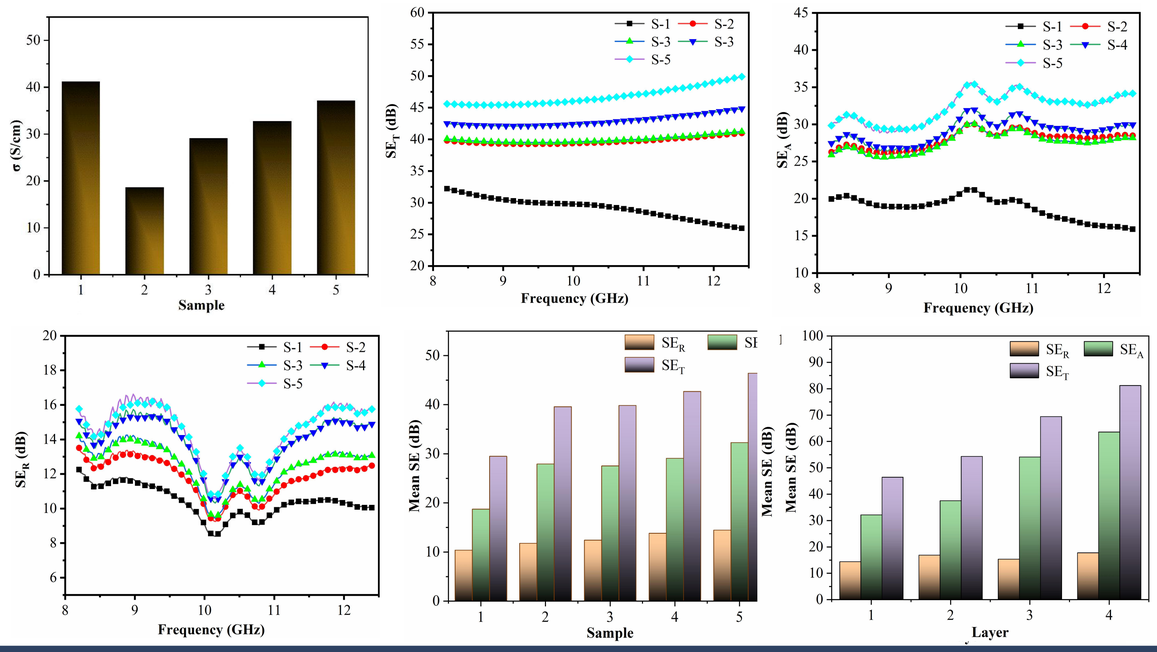
Morphology and structural information



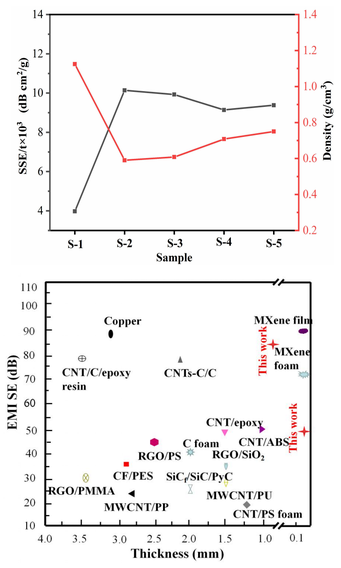
Phase composition and chemical bonds

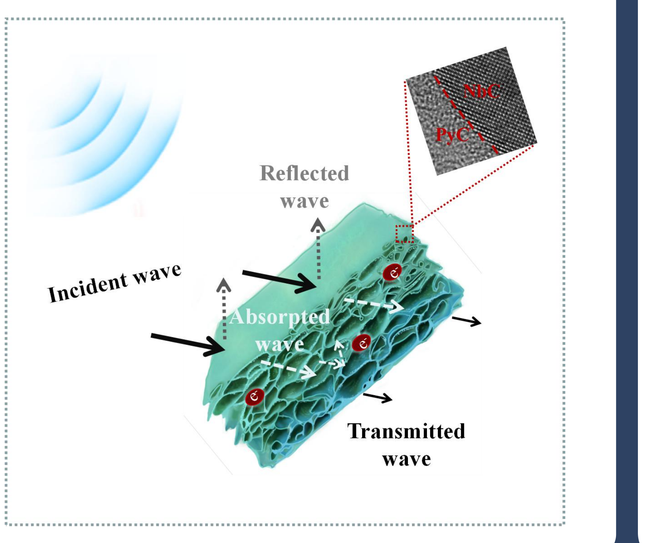


The electrical and electromagnetic performance



Model verification





Conclusion

- Multi-loss mechanisms were estabilshed by in-situ construction of heterogeneous NbC-PyC nano-interfaces
- The simultaneous optimization of thickness (55 μm), flexibility, density (0.75 g/cm^3) as well as shielding effectiveness (55 dB, 99.9995%) of NbC-based free-standing films were achieved.
- An eco-friendly and commercially effective route for the recycling of used paper was developed by using them in electromagnetic field.

Reference

1. K. Majdzadeh-Ardakani, M.M.B. Holl, Nanostructured materials for microwave receptors, Progress in Materials Science 2017, 28, 221-245.
2. H.L. Xu, X.W. Yin, et al. Mesoporous carbon hollow microspheres with red blood cell like morphology for efficient microwave absorption at elevated temperature, Carbon, 2018, 132, 343-351.