



Topic of the Speech:

Functional 3D Electrospun Materials

Professor Bin Ding

Donghua University
China



Professor Bin Ding is the Vice Director of Innovation Center for Textile Science and Technology in Donghua University. He has been awarded as “Cheung Kong Scholar” of Ministry of Education of China. Since 2000, Prof. DING has made significant contributions to the controllable fabrication, functionalization and application of electrospun nanofibrous materials.

He has authored and co-authored over 230 peer-reviewed SCI papers published on some prestigious journals such as Nat. Commun., Sci. Adv., Adv. Mater., ACS Nano, Prog. Mater. Sci., etc., edited a Chinese book and two English books, co-edited 12 book chapters, and held over 60 approved innovation patents.

Prof. Ding has served as editor of 4 international academic journals and acted as editorial board member of 4 international academic journals. He has undertaken more than 30 research projects ranging from Ministry of Science and Technology of China, NSFC, Shanghai Municipal Education Commission to industrial community. He has received many precious honors including the Distinguished Achievement Award of The Fiber Society (USA), First Prize of Scientific and Technological Progress of China National Textile and Apparel Council, First Prize of Technical Invention in Shanghai, and Second Prize of Scientific and Technological Progress in Tianjin, etc.

Functional 3D Electrospun Materials

Bin Ding*

Innovation Center for Textile Science and Technology, Donghua University, Shanghai 200051, China

*Presenter's email: binding@dhu.edu.cn

ABSTRACT (NO MORE THAN 500 WORDS:)

Electrospun nanofibers, as the forefront of advanced fibrous materials, hold extraordinary potential applications ranging from environmental, energy to biology owing to their integrated advantages of fine diameter, extremely high aspect ratio, and ease of scalable synthesis from various materials. Despite their outstanding potential, the major problem associated with electrospun nanofibers is their anisotropic lamellar deposition character, which leads to the bottlenecks in further improving the thickness and porosity of current electrospun nanofibrous materials. Alternatively, three-dimensional nanofibrous aerogels (NFAs) with both high porosity and excellent compressive resilient might open up the possibility of solving the above problem and expand the applications of electrospun nanofibers; however, creating such NFAs has proven extremely difficult. Herein, we demonstrate a novel strategy to create fibrous, isotropically-bonded elastic reconstructed (FIBER) NFAs with a hierarchical cellular structure and superelasticity by combining electrospun nanofibers and the fibrous freeze-shaping technique. Our approach causes the intrinsically lamellar deposited electrospun nanofibers to assemble into elastic bulk aerogels with tunable densities and desirable shapes. The resulting FIBER NFAs exhibited densities of $> 0.12 \text{ mg cm}^{-3}$, rapid recovery from deformation, slight plastic deformation with 14.5% after 1000th cyclic compression at a large strain of 60%, efficient energy absorption, and multifunctionality in terms of the combination of sound absorption, warmth retention and oil/water emulsion separation. Furthermore, the corresponding nanofibrous hydrogels with ultrahigh water content (99.8 wt%) were also prepared and exhibited robust elastic-responsive sensitivity. Additionally, the newly developed ceramic nanofibrous aerogels possess low thermal conductivity ($\sim 0.025 \text{ W m}^{-1} \text{ K}^{-1}$) and intriguing temperature-invariant superelasticity to 1100°C . The successful synthesis of such fascinating FIBER NFAs provide a new insight into the design and development of multifunctional NFAs for various applications.

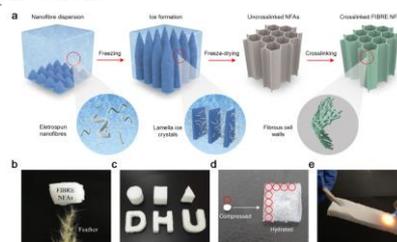


Figure 1. (a) Schematic illustration of the fabrication of FIBER NFAs. (b) A 20-cm^3 FIBER NFA ($\rho = 0.12 \text{ mg cm}^{-3}$) stands on the tip of feathers. (c) FIBER NFAs with diverse shapes. (d) The water retention capacity of the nanofibrous hydrogels (NFH). A sample of squashed and dried NFH of $\sim 10 \text{ mg}$ could hold $\sim 5 \text{ g}$ of water. (e) Ceramic nanofibrous aerogels heated by a butane blowtorch without any damage.