

Reproducible and tunable electrospun 3D porous buckled-PCL microfibrous scaffolds developed by self-directing single polymer jet

Abstract

We disclose the first observation during electrospinning that a novel self-directing single jet may emerge from the combination of mechanical and electrical bending instabilities guided by charge-balancing occurring on the collector electrode. The alternations of commonly observed whipping motion and the newly found cantilever-like single jet enable layer-by-layer self-construction of reproducible 3D microfibrous scaffolds (MFS) consisting of dual fiber morphologies, namely, a base/top layer with buckled/random fiber mat, respectively. Physical characterization revealed that the porosity and mechanical properties of the scaffold can be tailored precisely with excellent reproducibility. MFS has better 3D interconnected pores and 10-fold enhanced stretchability. Overall findings implicate that the unique properties of our microfibers may extend to applications far beyond tissue engineering.

Technological Advantages

1. Self-guiding single polymer jet.
2. High-reproducibility.
3. Scaffold properties can be controllable and tunable.
4. Higher tensile/mechanical strength.
5. Gradient porous structure and broader pore size distribution.
6. Good structural integrity.
7. Durable.
8. Eco-friendly (biodegradable).

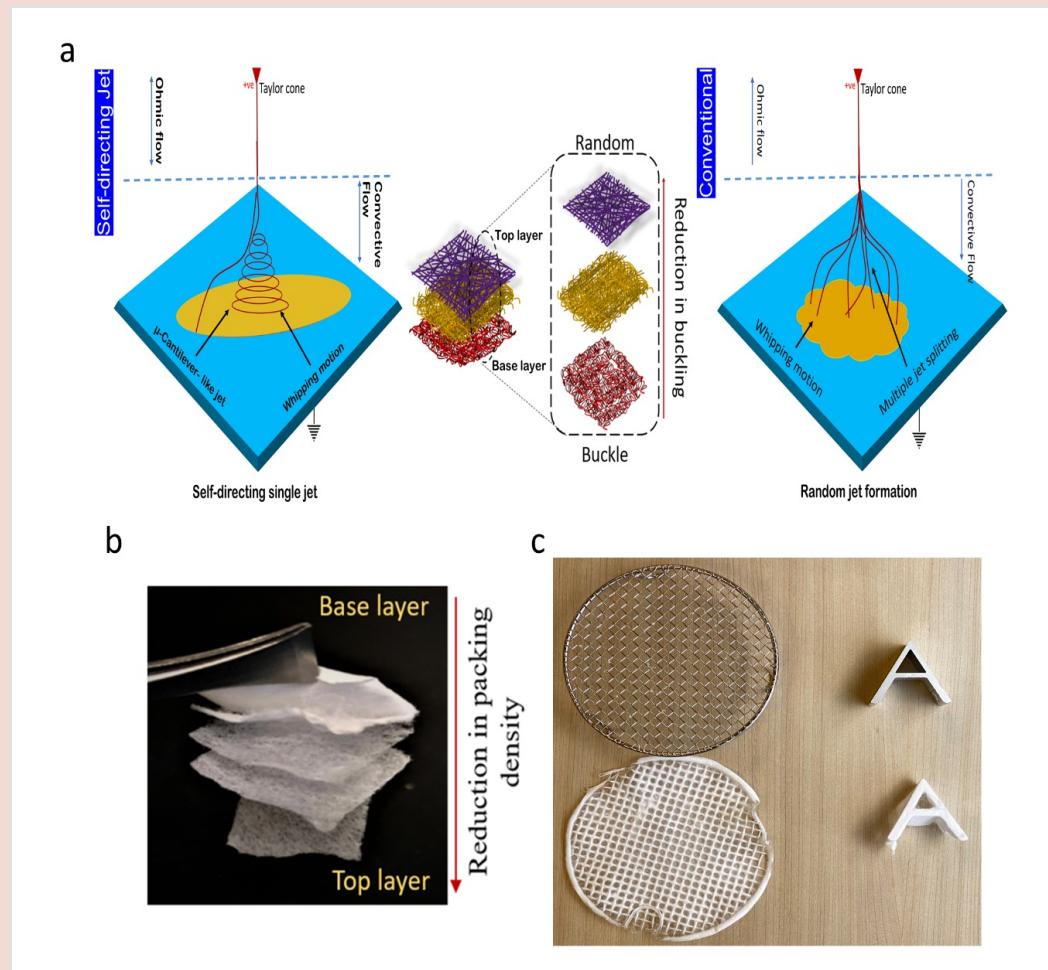


Fig1. Electrospinning process. a) Schematic illustration of electrospinning process of self-directing jet producing hybrid scaffold and traditional random fiber formation. b) Layer-by-layer deposition (peelable discrete layers). c) 3D Template direct-writing.

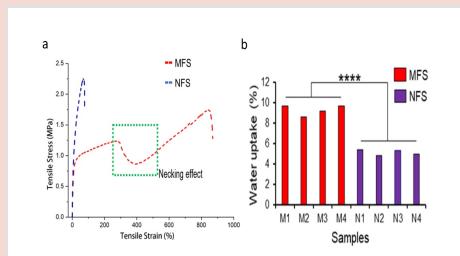


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Applications of Technology

1. Tissue engineering
2. Drug delivery
3. Stents/implants
4. Water/Oil filter & Purifier including air
5. Masks

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