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Topic of the Speech:
Preparation and Characterization of Three Dimensional Nano-fibrous Scaffold

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Dr. Jiashen Li is a Lecturer in Textile Science & Engineering in the Department of Materials. His research interests involve the science and technology underpinning processing-structure-property relationships in functional fibers and textiles; including nano fibres, bio-functional fibres, smart fibres and textiles, e-textile, and structural fibre-composites. With more than ten years' experience on fibre spinning, he has significantly expanded his studies of advanced functional polymer fibres and textiles.

Dr. Jiashen Li obtained his PhD in Polymer Materials (Physics) from Tianjin University (China) in 2001. He then spent thirteen years conducting biomaterials and fibre spinning in The Hong Kong Polytechnic University (Hong Kong), before joining the University of Manchester in 2015.

ABSTRACT SUBMISSION
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Preparation and Characterization of Three Dimensional Nanofibrous Scaffold

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ABSTRACT (NO MORE THAN 500 WORDS:)

Poly(L-lactic acid) (PLLA) and polycaprolactone (PCL) are both biopolymer materials with high potential in biological applications, particularly in bone regeneration. Firstly, a simple fabrication method utilizing electrospinning technology and acetone treatment was employed to induce the formation of heterogeneous porous PLLA/PCL fibres. Subsequent analysis revealed that acetone induced PLLA recrystallization, forming a porous structure, while PCL formed a shell-like structure on the fibre surface, effectively crosslinking the electrospun fibres together. These heterogeneous porous PLLA/PCL fibres exhibited excellent tensile strength, reaching 5.07 ± 0.39 MPa. Additionally, the heterogeneous porous PLLA/PCL fibres demonstrated excellent cell compatibility. These advancements have led to widespread applications of these heterogeneous porous PLLA/PCL fibres in the field of bone tissue engineering.

Secondly, a strategy involving ultrasonic dispersion was successfully employed to introduce amorphous calcium phosphate (ACP) nanoparticles into porous PLLA fibres. ACP nanoparticles were mixed with PLLA electrospinning solution to prepare composite fibres. During subsequent acetone treatment, porous composite fibres were obtained, with ACP nanoparticles exposed on the fiber surface. The developed porous composite fibrous membranes exhibited an extremely high surface area and rapid biomineralization ability. Importantly, compared to pure PLLA fibers, the porous composite membranes showed improved biocompatibility. Hence, the combination of PLLA with bioceramic materials holds significant promise in bone tissue engineering applications.

Finally, a 3D porous scaffold was fabricated using a combination of electrospinning, high-speed homogenization, and porogen leaching techniques. Shortened PLLA fibres were reconstructed into a 3D fibrous scaffold with interconnected macropores in the hundred-micrometer range. PCL acted as a binder between the fibres in the final scaffolds. By incorporating bioactive glass, the water contact angle of the prepared 3D fibrous scaffold decreased from 100.6° to 79.7°. Consequently, cell attachment and proliferation on the 3D fibrous scaffold were improved. Moreover, compared to electrospun fibrous membranes, the 3D fibrous scaffold exhibited excellent cell infiltration ability and superior biological performance.