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Fabrication of biomimetic hierarchical structures using electrospinning combined with template wetting method for dry-adhesive applications

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Biomimetic poly (vinylidene fluoride) (PVDF) hierarchical structures were fabricated using electrospinning combined with template wetting method for dry-adhesive applications. In the first step, electrospinning was used to produce micron sized PVDF fibers. Following this step, the fibers were placed on porous anodized aluminum oxide (AAO) template. The setup was heated above the glass transition temperature of PVDF to enable the flow of PVDF within the porous channels and to grow nanometer sized pillars on the surface of electrospun fibers. The morphology of the fabricated hierarchical electrospun fibers was investigated using scanning electron microscopy (SEM). The adhesion performance of the samples was investigated using nano-indenter. A flat circular indenter tip (diameter=10μm) was used to indent the samples and then retracted back to measure the pull-off force between the indenter tip and the samples. The adhesion performance of both neat PVDF fibers and hierarchical PVDF structure were investigated. The hierarchical PVDF structure exhibit increased pull-off force compared to neat PVDF control samples due to its improved Vander Waals interactions with the indenter tip. The effect of penetration depth of indenter tip on the pull-off force was also investigated. The achieved experimental results indicate that these biomimetic adhesive structures can potentially be used as reusable adhesives for wide variety of applications.

Biography

Rahul Sahay graduated with a PhD in Mechanical Engineering from National University of Singapore, Singapore (2013) and also worked as Research Associate at School of Materials Science and Engineering, Nanyang Technological University, Singapore, (2010–2012). After completion of his PhD degree, he was appointed as Assistant Professor in Mechanical Engineering Department at Amity University, Haryana, India (2013–2014). He is currently a Research Fellow at EPD, Singapore University of Technology and Design, Singapore (since 2014). His current research interests include fabrication of nano-materials for reusable adhesive applications and development of nano-fibrous 3D printer for fabricating flexible electronics.

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