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Carbon nanotube based gecko inspired self-cleaning adhesives

SUNNY SETHI, LIEHUI GE, The University of Akron, PULICKEL AJAYAN, Rensselaer Polytechnic Institute, DHINOJWALA ALI, The University of Akron — Wall climbing organisms like geckos have unique ability to attach to different surfaces without use of any viscoelastic material. The hairy structure found in gecko feet allows them to obtain intimate contact over a large area thus allowing them to adhere using van der Waals interactions. Not only high adhesion, the geometry of the hairs makes gecko feet self cleaning, thus allowing them to walk continuously without worrying about losing adhesive strength. Such properties if mimicked synthetically could form basis of a new class of materials, which, unlike conventional adhesives would show two contradictory properties, self cleaning and high adhesion. Such materials would form essential component of applications like wall climbing robot. We tried to synthesize such material using micropatterned vertically aligned carbon nanotubes. When dealing with large areas, probability of defects in the structure increase, forming patterns instead of using uniform film of carbon nanotubes helps to inhibit crack propagation, thus gives much higher adhesive strength than a uniform film. When carbon nanotube patterns with optimized aspect ratio are used, both high adhesion and self cleaning properties are observed.

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