Clustering and Compliance Distribution Induced Directionality in Bioinspired Fibrillar Adhesives

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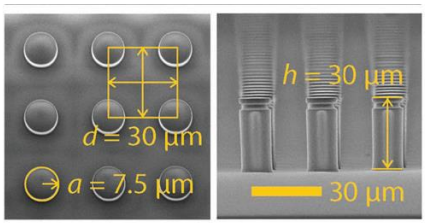

Figure 1. Typical geometry of fibrillar adhesive array structures. **Reprinted from "Benefit of Backing-Layer Compliance in Fibrillar Adhesive Patches—Resistance to Peel Propagation in the Presence of Interfacial Misalignment," by J.A. Booth, M. Bacca, R.M. McMeeking, and K.L Foster, 2018, Advanced Materials interfaces, 5, p. 1800272**

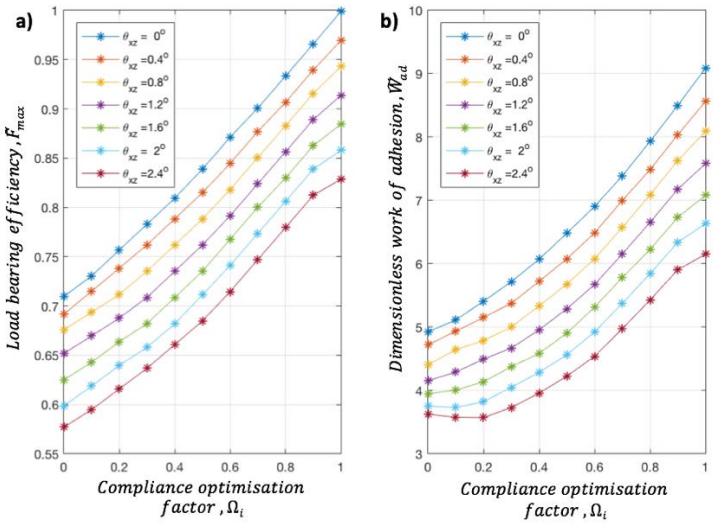

Figure 2. Load bearing efficiency and work of adhesion as a function of compliance optimisation

Natural adhesion systems on the feet of various species of animals such as beetles, spiders, and geckos were found to achieve adhesion through van der Waals forces. This property is key in enabling these animals to traverse nimbly on vertical and even inverted surfaces. In the past two decades, researchers have made substantial progress in developing synthetic mimics which replicate natural adhesion systems. These mimics commonly take shape as arrays of polymeric micro-pillars (fibrils) atop of a backing layer of the same material (Figure 1). They are expected to have great utility in applications such as pick and place handling systems, surgical adhesives, and climbing robots.

This project utilizes an existing analytical detachment model to test potential means of manifesting detachability in adhesive arrays. Detachability is the quality of fibrillar adhesives to easily and controllably separate from adheres surfaces. The study showed that peel detachability can be improved through locally varying the compliance of fibrils according to a distribution previously developed by Dr. Bacca (Figure 2). The degree to which the distribution is satisfied is termed the 'compliance optimisation factor'. Future work will involve continued processing and qualification of the project's findings.