

Abstract Submitted
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Renewable Interfaces: Surface Topography Actuation for Complex Biological Adhesion Control LUKA POČIVAVSEK, University of Pittsburgh Medical Center, SANGHO YE, University of Pittsburgh, KATHLEEN CAO, KA YEE C. LEE, University of Chicago, SACHIN VELANKAR, WILLIAM WAGNER, University of Pittsburgh — Controlling adhesion at biological interfaces is a complex problem with great biomedical importance. We use dynamic wrinkling, generated with PDMS/UVO chemistry under different macroscopic strains ($\epsilon_{ij} \sim 0.3$), to create a mechanical interfacial term that frustrates particle adhesion. This device actuates surface topography between flat (zero surface confinement χ_{ij}) and wrinkled surfaces ($\chi_{ij} \sim (A/\lambda)^2$, where A and λ are wrinkle amplitude and wavelength, respectively), with a maximum rate of 0.6 Hz. Un-actuated PDMS placed in contact with whole sheep blood shows near total surface coverage with adhered platelets over 90 min. Actuation showed a nearly 100-fold decrease in platelet adhesion. Interestingly, topographic actuation is four times as effective compared to flat surface actuation in controlling platelet adhesion. Our model explores the competition between surface tension terms ($U_\gamma = \gamma\epsilon_{ij}$) and interfacial elastic terms ($U_\chi = E_{ij}(t \cdot \epsilon_{ij}^2 + t^3 \cdot (\chi_{ij}/\lambda^2))$) generated because of actuation and wrinkling, where E_{ij} is platelet modulus and t is characteristic platelet length scale. The condition for de-adhesion is $U_\chi > U_\gamma$.

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