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Speedy self-healing

The secrets of micellar coating dynamics revealed by AFM.

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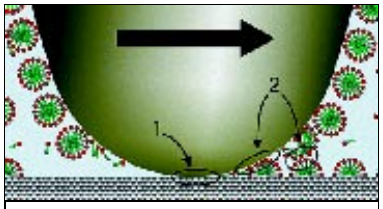

The AFM tip (moving left to right) in contact with both the substrate (1) and the micellar aggregates (2). Reprinted with permission from ref. 1. Copyright (2006) American Chemical Society.

Surfactants on a surface self-assemble into highly ordered coatings, which have potential for corrosion inhibition and lubrication. One of the most appealing characteristics of these so-called micellar coatings is their ability to self-heal, but the timescale at which this occurs is difficult to assess with conventional imaging techniques. Schniepp *et al.* have adapted traditional atomic force microscopy (AFM) to address this issue. In contrast to conventional AFM, where the imaging tip is held above the surfactant layer, Schniepp *et al.* push the tip onto the graphite substrate, thereby piercing the micellar coating. In this regime, surprisingly both the substrate and the hemicylindrical surface micelles are visible, as the substrate is imaged by the end of the tip and the coating micelles by the sides. The coating is disrupted each time the tip scans the image area, but as its image appears complete, it must reform before the tip next passes over the same area. The authors can therefore infer the self-healing timescale from the tip scan rate — for the surfactant sodium dodecyl sulphate on graphite, they find it to be less than 6 ms.

References

1. Schniepp H. C., Saville D. A. & Aksay I. A. Self-healing of surfactant surface micelles on millisecond time scales. *J. Am. Chem. Soc.* published online August 31 2006 Article