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Pattern Formation in Dewetting Nanoparticle/Polymer Bilayers ALAN ESKER, RITUPARNA PAUL, UFUK KARABIYIK, MICHAEL SWIFT, JOHN HOTTLE, Virginia Tech — Comprised of inorganic cores and flexible organic coronae with 1-2 nm diameter monodisperse sizes, polyhedral oligometric silsesquioxanes (POSS) are ideal model nanofillers. Our discovery that one POSS derivative, trisilanolphenyl-POSS (TPP), can form Langmuir-Blodgett (LB) films on hydrophobic substrates, allows us to create thin film bilayers of precisely controlled thickness and architecture. Work with poly(t-butylacrylate) (PtBA)/TPP bilayers reveals a two-step dewetting mechanism in which the upper TPP layer dewets first, followed by the formation of isolated holes with intricate, fractal, nanofiller aggregates. Like the PtBA/TPP bilayers, polystyrene (PS)/TPP bilayers also undergo a two-step dewetting mechanism. However, the upper TPP layer initially forms cracks that may arise from mismatches in thermal expansion coefficients. These cracks then serve as nucleation sites for complete dewetting of the entire bilayer. Understanding the rich diversity of surface patterns that can be formed from relatively simple processes is a key feature of this work.

> Alan Esker Virginia Tech

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