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Functional gradients with controlled steepness on self-assembled aminosilane monolayers

YING ZOU, STEVE STORY, SHANE HARTON, HARALD ADE, Department of Physics, North Carolina State University, Raleigh, NC 27695 — A high throughput, and cost-effective way to fabricate functional gradients of controlled steepness (up to $\sim 10\mu m$ for full gradient) on organic self assembled monolayer (SAM) films has been achieved. The exposure of a aminopropyltrimethoxysilane(APTES) film prepared on a SiO$_x$ substrate to ultraviolet (UV) light, with and without the creation of ozone, is controlled by a movable shutter that shadows the sample from the UV source. The shutter to the substrate spacing sets a lower limit to the steepness of the gradient, whereby both the diffusion field of ozone and the divergence of incident UV light are responsible. Through the attachment of 0.26 $\mu m$ sized polystyrene (PS, carboxyl-group ended) microspheres (MSs) onto the exposed APTES films via chemical reaction in an activated MS suspension, the fabricated gradient can be visualized directly with a visible light microscope operated in Normarsky interference mode. The short MS density-saturation time observed suggests that covalent bonding is established between the MSs and the APTES film through the reaction of carboxyl- with amine- groups [1]. The use of a linear, variable shutter speed in conjunction with the saturation time allows for the variation and control of the gradients steepness. Reference: [1] S. Herrwerth et al Langmuir 19(2003) 1880-1887

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