Structured Polymeric Templates: Combinatorial Probes for Cellular Response

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Novel high-throughput gradient methods have been developed to generate a range of surface structures by dewetting and phase separation on chemically patterned substrates. The research is motivated by an increasing awareness in the biomedical industry and the tissue culture community that surface interactions are critical in clinically relevant *biocompatible* materials. Surface topography and functionality are a few of the key parameters that determine cell adhesion, expression, growth and phenotype. We utilize our knowledge of dewetting and phase separation on patterned substrates to efficiently generate topologically and functionally structured surfaces in a controlled manner. The high level of control is taken further by imposing a discrete step gradient in the pattern dimensions on the substrates allowing us to create a range of surface structures on a single substrate.

Patterns of chemical functionalities were created by soft lithography to modulate the surface energy in bands of -CH_3 and –COOH terminated self-assembled monolayers of equivalent length. The imposition of a symmetry-breaking surface energy field such as a chemical pattern results in mode coupling between these dynamic processes and the pattern frequency, giving spatial and dimensional control of these otherwise random phenomena. The surface morphology is sensitive to film thickness, spatial resolution, and the symmetry of the underlying chemical pattern. Thin film dewetting on patterned substrates was utilized to let polymer physics efficaciously define different topographies, while phase separation creates surface relief with spatially resolved regions conducive for cellular reception. The combinatorial approach enables us to address cell response to *structured* biomaterials in a systematic high throughput manner.

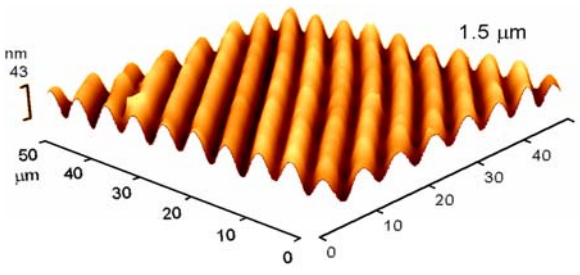

Figure 1 Pattern induced nanometric ridged dewet topology (Scanning Force Microscopy images).

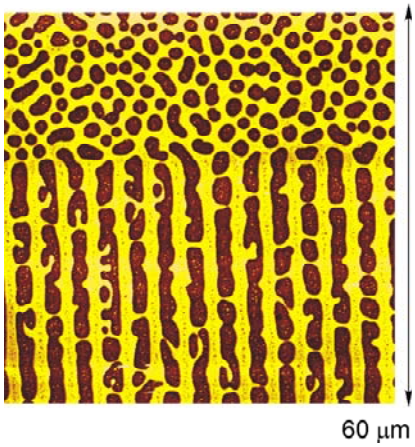

Figure 2 Spatially resolved phase separation of poly-ε-caprolactone (PCL) / poly-DL-lactic acid (PDLA) blen