Hierarchical Structures on Soft Polymers Induced by Ion Beam/Plasma Treatment for Biological Application

문명운[a], 이광렬[a]
[a]KIST 미래융합기술연구소(mwmoon@kist.re.kr)

Abstract

A stiff skin forms on surface areas of a flat PDMS upon exposure to ion beam /plasma leading to ordered surface wrinkles. By controlling the ion flux of the PDMS, one can create a variety of patterns in the wavelengths in the micron to nanometer range, from simple one-dimensional wrinkles to peculiar and complex hierarchical nested wrinkles. A simple but novel method for fabrication of nested hierarchical wrinkling patterns on polymeric surface is demonstrated using single-step or multi-step ion beam/plasma treatment. The morphology of wrinkle patterns, specifically the wavelength and amplitude of each wrinkle generation, is controlled by the treatment time and stretching release after each treatment step. By systematically varying these two key experimental factors, wrinkle patterns with wavelength in the range of 50 nm to 10 um and amplitude in the range of 20 – 400 nm were created in hierarchical scales [1,2].

These patterns were further employed to study the role of surface topology on the behavior of NIH-3T3 cells. Cells aligned and elongated on these patterns depending on the surface topology. Moreover, the cells proliferated on these nanopatterned substrates and gave rise to progeny that was also aligned on these nanopatterned substrates.

Keywords: Ion beam; polymer; wrinkling; cell alignment, nanopatterned substrate

References

1. M.-W. Moon, et al, PNAS., 104 (2007) 1130-1133
2. M.-W. Moon, Ashkan Vaziri, Scripta. Mat., 60 (2009) 44-47
3. S. Chung, J. H. Lee, M.-W. Moon, et al, Adv. Mater. 20 (2008), 3011-3016