

Electric field-induced pillar patterns on PMMA thin film

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Self-assembly of polymer nano and microstructure has demonstrated the potential of constructing periodical structure on the surface of polymer film. The surface instability of polymer films through the interaction between molecules and surround medium such as electric field and thermal gradient is the driving force to form surface pattern. Considered the potential applications of surface structures on PMMA substrates in the patterning of metal films for plasmonics and flexible electronics. We investigated the temporal evolution of pillars formed on PMMA films between two parallel plates under the action of an electric field. A simple model was developed to analyze the growth of a liquid pillar under the action of an electric field between two parallel electrodes. A quadratic relationship between time and the diameter of the pillar was obtained. The diameter of the pillar increases with time. Large electric field assists the growth of the liquid pillar, while a liquid with a large viscosity hinders the growth of the liquid pillar. The field-induced formation and growth of PMMA pillars on PMMA films were observed using the configuration of a parallel capacitor. Pillars of larger sizes and smaller densities were formed on thicker PMMA films than on thinner PMMA films. The root mean square diameter of the pillars increases with the increase of the annealing time and annealing temperature. The growth behavior of the pillars can be described by an Arrhenius relation with an activation energy of 24.4 kJ/mol, suggesting that the growth of the pillars is controlled by a thermal activation process.

Biography:

Professor Sanboh Lee has been endowed Tsing Hua Professor in the Department of Materials Science and Engineering, National Tsing Hua University since 2003. He was a visiting professor at Lehigh University (1987-1988) and National Institute of Standards and Technology (1996-1997, 2003-2004). He has also been received numerous awards. To name several of those awards, he was the recipient of 1998 Roon Foundation Award from Federation of Societies for Coatings Technology, the recipient of 2000 Ho Chin Tui Award. He has also awarded ASM International Fellow in 2004 and Fellow of Materials Science Society-Taiwan in 2009. He has been Tsing Hua Chair Professor since 2006. He has been the Adjunct professor of Beijing University of Science and Technology since 2005. He is a member of ASM International, TMS, American Physical Society, and Materials Research Society. He published more than 230 articles in peer-reviewed international journals.