Regular ZnO nanopillar arrays by nanosphere photolithography

Z. Szabó a, J. Volk a,b,*, E. Fülöp a, A. Deák a, I. Bársony a,b

2013

a Institute for Technical Physics and Materials Science, Research Centre for Natural Sciences, 1025 Budapest, Pusztaszeri út 59-67, Hungary
b University of Pannonia, Faculty of Information Technology, Doctoral School of Molecular- and Nanotechnologies,8200 Veszprém, Egyetem u´t 10, Hungary

Highly regular vertical ZnO nanopillar arrays were hydrothermally grown through a nucleation window pattern generated by nanosphere photolithography. The in-plane intensity modulation of the exposing ultraviolet light in the photoresist was performed by Sto¨ber silica or polystyrene nanospheres in the masking Langmuir–Blodgett monolayer. By comparing six different nanosphere diameters in the 180–700 nm range only those with diameter above the exposure wavelength of 405 nm generate a pattern in the thin photoresist layer. The pattern quality is improving with increasing diameter, therefore, the masking for nanopillar growth was demonstrated with 700 nm polystyrene nanospheres. The results of the nanosphere photolithography were supported by finitedifference time-domain calculations. This growth approach was shown to have the potential for low-cost, low-temperature, large area fabrication of ZnO pillars or nanowires enabling a precise engineering of geometry.