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Nano-contact printing lithography for preparing large-area nano-structures with industrial applications

Nano-fabrication plays a key role in the development of nano-science and nano-technologies and their applications. Photolithography is still now the dominant method for patterning nano-structures with a feature size down to few nm on a large wafer or substrate. However, there are some serious limitations and restrictions in this method which make it not so available to many researchers. Alternative nano-fabrication technologies have been developed in the past two decades. Among them, nano-imprinting and nano-contacting lithography have shown great potentials for fabricating various kinds of nano-structures over a large pattern area with a relatively simple and cost-effective approach. This presentation will address several innovative methods based on nano-imprinting and contact printing lithography. First of all, a soft photomask lithography method is developed which can improve the patterning resolution of conventional contact-type photolithography from μm to sub-μm or even nm scale. As an example, this method has been used for fabricating conical-shape surface structures on sapphire substrate of a light-emitting diode to enhance light extraction efficiency. Secondly, a metal contact printing lithography has been developed for patterning metallic nano-structures on both hard and soft substrates. Following by thermal annealing, one can achieve various kinds of metallic nano-particles which are highly uniform in particle size and deployed precisely and regularly on a substrate. Localized surface plasma resonance (LSPR) can be excited for many biomedical and optoelectronic applications. Finally, a curved surface lithography will be addresses which can directly pattern nano-structures not only on a planar substrate but also on a convex or concave surface of a substrate. Metallic, polymer, or dielectric nano-structures or a combination of them can be created by combining these lithography methods along with other standard material processing methods. The common features shared by all these proposed lithography methods are small line width, large patterning area, using simple equipment readily available in laboratories, and cost-effective.

Speaker Biography

Dr. Yung Chun Lee received his B.S. degree in Mechanical Engineering (1985) and M.S. degree in Applied Mechanics (1989) both from National Taiwan University, Taipei, Taiwan, and Ph.D degree in Theoretical and Applied Mechanics (1994) from Northwestern University, IL, USA. He was a post-doc. researcher (1994-1996) in the Department of Engineering and Applied Physics, Cornell University, NY, USA, and a project engineer (1996-1997) in Hon-Hai Precision Industry Inc., Taipei, Taiwan. He joined the Department of Mechanical Engineering, National Cheng Kung University (NCKU), Tainan, Taiwan in 1997 and is now a Distinguished Professor there.

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