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New Fabrication Methods of Nano-Structures and Their Engineering Applications

This paper presents several innovative and effective methods for fabricating nano-structures with specific physical properties and engineering applications. The goal is to achieve nano-patterning and nano-fabrication on a wafer-size (4”~8”) substrate using relatively simple equipment and inexpensive processes. In the past one decade, the author has developed several nano-fabrication method based on the ideas of 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 directly 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 feature size (sub-micrometer/nm), large patterning area size (~8”), high throughput, using simple equipment readily available in laboratories, and cost-effective. Potential engineering applications fro industry will be addressed.

Biography

Yung-Chun Lee graduated from Northwestern University, IL, USA, with a Ph.D. degree in Theoretical & Applied Mechanics. In 1997, he joined the department of Mechanical Engineering in National Cheng Kung University, Tainan, Taiwan, and is now a distinguished professor. His researches has been focusing on developing novel nano-fabrication technologies and the engineering applications of nano-structures in industry. Since 2004, he has been continuously served as the principle investigator of several major national nano-projects sponsored by the Ministry of Science and Technology (MOST) of Taiwan. He has published more than 50 papers and hold 20 patents in related research area..

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