Plasmonic and metallic nanolasers

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Abstract

The modeling, fabrication and operation of recently demonstrated lasers employing metallic nano-cavities will be examined in this presentation. An overview will also be given of latest results from devices employing metal-insulator-metal structures with sub-wavelength dimensions. Finally future development directions, challenges and prospects for such lasers will be discussed.

Extended Abstract

There has been considerable interest in nano-cavity lasers, both from a scientific perspective for investigating fundamental properties of lasers and cavities, and also to produce smaller and better lasers for low-power applications. Light confinement on a wavelength scale has been reported in photonic crystal nano-cavities. Even stronger light confinement can be achieved in metallic cavities which can confine light to volumes with dimensions considerably smaller than the wavelength of light. It was commonly believed, however, that the high losses in metals are prohibitive for laser operation in metallic nano-cavities. Recently we have reported lasing in a metallic nano-cavity filled with an electrically pumped semiconductor. Importantly, the manufacturing approach employed for these devices permits even greater miniaturization of the laser concept. Furthermore, the approach allows for complex device shapes and the guiding of light between devices. The presentation will look at the modeling, fabrication and operation of these devices. An overview will also be given of latest results from devices employing metal-insulator-metal structures with deep sub-wavelength dimensions. Finally future development directions, challenges and prospects for such lasers will be discussed.

Martin T. Hill

Martin T. Hill received the Ph.D. degree from Curtin University of Technology, Curtin, Australia, in 1997. Since 1998, he has been in the Department of Electrical Engineering at the Technical University of Eindhoven, Eindhoven, The Netherlands. Here he was initially involved in research on photonic components for optical switching. Later, his work was directed more at integrated optics devices. And, most recently he has been predominately involved in investigating metallic nano-structures to permit the further miniaturization of lasers.