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Fabrication of Microbowtie Structures Using Electron-beam Lithography for a New Optical Probe

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Abstract

A microbowtie array critical to a newly developed optical probe is studied. The optical probe is used for high speed detection of nanoscale objects. Based on the concept of Wave Interrogated Near Field Array, an array of microbowtie structures is acting as a detector in amplifying the incident light source to overcome the difficulties of the conventional optical probe that are limited by the diffraction limits of the optical light. In the present study, the micro bowties are fabricated by an electron beam lithography technique. The paper begins with an introduction of the probe concept and then the design considerations are given followed by the details of the fabrication procedure. Two different substrates are considered to study the charge accumulation problem caused by an insulating substrate required by the probe. The effect of the charge accumulation on the fabrication procedures is specifically discussed. Results indicate that the bowtie structure with an indium- tin-oxide coated glass substrate can minimize the charge accumulation problem, making it one of the most suitable substrates for the bowtie structures considered. The paper concludes with recommendations for making even smaller nano- sized bowtie structures.