

Electric radiation mapping of silver/zinc oxide nanoantennas by using electron holography

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J. Appl. Phys. 117, 034306 (2015); <http://dx.doi.org/10.1063/1.4906102>

Abstract.

In this work, we report the fabrication of self-assembled zinc oxide nanorods grown on pentagonal faces of silver nanowires by using microwaves irradiation. The nanostructures resemble a hierarchal nanoantenna and were used to study the far and near field electrical metal-semiconductor behavior from the electrical radiation pattern resulting from the phase map reconstruction obtained using off-axis electron holography. As a comparison, we use electric numerical approximations methods for a finite number of ZnO nanorods on the Ag nanowires and show that the electric radiation intensities maps match closely the experimental results obtained with electron holography. The time evolution of the radiation pattern as generated from the nanostructure was recorded under in-situ radio frequency signal stimulation, in which the generated electrical source amplitude and frequency were varied from 0 to 5 V and from 1 to 10 MHz, respectively. The phase maps obtained from electron holography show the change in the distribution of the electric radiation pattern for individual nanoantennas. The mapping of this electrical behavior is of the utmost importance to gain a complete understanding for the metal-semiconductor (Ag/ZnO) heterojunction that will help to show the mechanism through which these receiving/transmitting structures behave at nanoscale level.