Regular ZnO nanorod arrays for ultraviolet photonic devices

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The aim of this work is to fabricate UV light emitting ZnO nanorod arrays, which combine the nano-cavity feature of individual rods and the merits of 2D photonic crystals. By using a novel synthesis route we obtained bottom-contacted, uniform, single crystal ZnO nanorods standing perpendicular to substrate surface in a triangular, a honeycomb, and an inverse designed SOE microlens [1] arrangement (Fig. 1a, b, and c). By the control of e-beam lithography and wet chemical growth the geometrical parameters such as rod length, diameter, and lattice constant were tuned precisely in the ranges of L=500 nm-5 μm, d=80-300 nm, and Λ=160-600 nm, respectively. The shorter sides of the ranges enables the first TE or TM photonic band-gap to overlap with the characteristic emission peak of bulk ZnO ($\lambda \approx 385$ nm), which can lead to an enhanced, narrow-band UV photo- or electroluminescence.

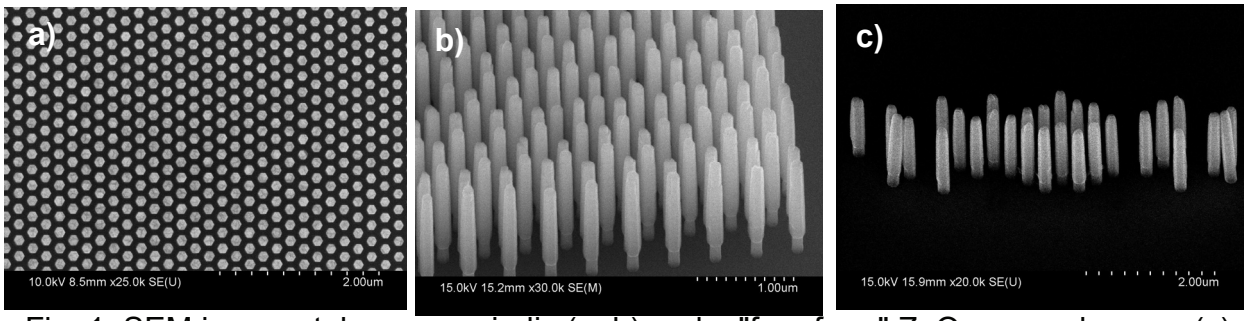

Fig. 1. SEM images taken on periodic (a, b) and a "free form" ZnO nanorod arrays (c).

[1] A. Håkansson, J. Sánchez-Dehesa, *Appl. Phys. Lett.*, **87**, 193506 (2005).