NANORODS GROWTH FROM SOLUTION BY A TEMPLATE APPROACH

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Fabrication of nanostructures with tailored morphology attracted an increased interest during the last decade, due mainly to the wide field of potential applications [1]. In order to achieve the goal a large number of preparation techniques ware developed. One such fabrication approach is represented by the so called template technique [2]. Thus, nanoporous membranes such as ion track polymer foils or anodic alumina are used as templates; by filling the pores with the desired material nanowires or nanotubes are obtained. Various techniques were applied for filling the pores such as electrochemical deposition or electroless plating [3, 4].
In this paper we present our results regarding solution growth of nanorods by employing a template approach.
Polycarbonate foils (30 and 100 micrometers thick) were prepared by swift heavy ions irradiation (e.g. Au with 11.4 MeV/nucleon) and subsequent etching. We employed an aqueous 5M NaOH etching bath at 50 °C, conditions which have as a result cylindrical pores with the diameter as a function of etching time (2 micrometers/hour etching rate).
These foils were further used as templates using a solution growth approach for filling the pores. We grew different types of rods of water soluble materials such as alkali-halides (NaCl, KCl) or potassium acid phthalate (KAP) both pure and doped with luminescent dyes.
The algorithm for preparation was extremely simple and consisted in dipping the membrane in a solution close to saturation. Slow evaporation resulted in complete saturation being obtained. In order to observe the rods by electron microscopy the foils were partially dissolved in dichlormethane. The growth of the material took place both inside the pores and onto the membranes surface. In Fig. 1 rods of alkali halides are presented. As one can see in Fig. 1 (b) the membranes are faceted showing the single crystalline growth tendency.
In Fig. 2 rods of potassium acid phthalate, also grown from solution are presented. Again it can be observed that the rods present facets, a consequence of single-crystalline growth.
The approach allowed the preparation of such KAP rods doped with fluorescent dyes such as rhodamine, dyes which are typically employed for dye lasing. The fluorescence properties of these dye doped nanorods were measured. Due to the combination between the lattice of the host (KAP) and the luminescence of the dye, up conversion phenomena were evidenced.
Such nanorods can be successfully employed as ultraminiaturized light sources for a wide field of applications ranging from communications and optoelectronics to life sciences.

Acknowledgments

The authors gratefully acknowledge the financial support of the Romanian Ministry of Education and Research (Projects CEEX 2/2006 and PNII 30/2007).

References:

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Figures:

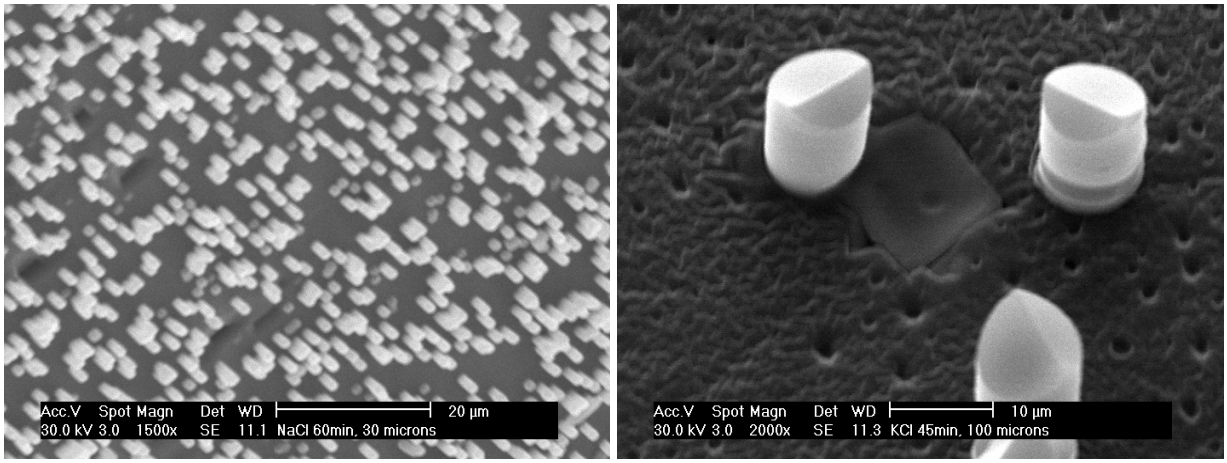

Figure 1. Alkali halide rods (a) NaCl and (b) KCl grown by the template method.

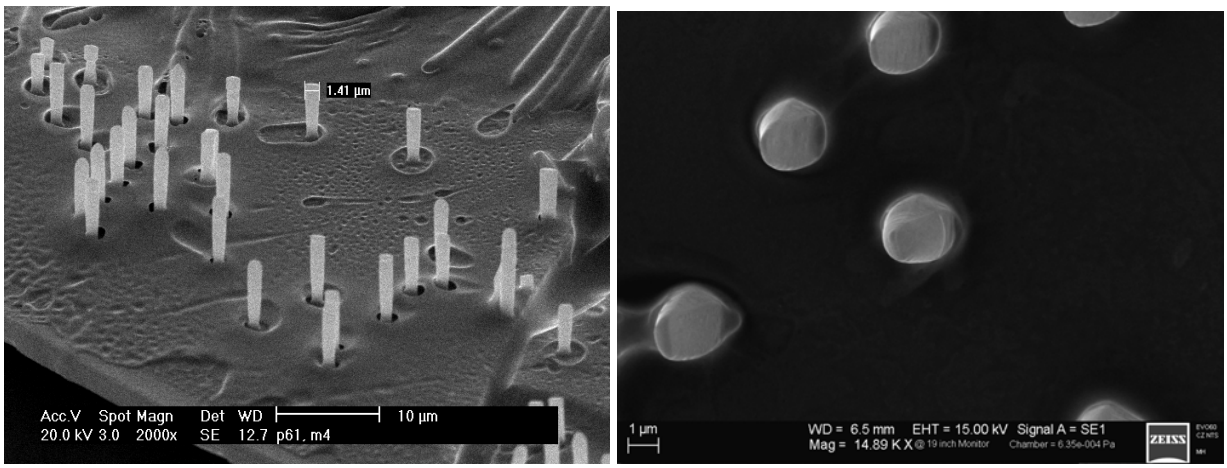

Figure 2. KAP rods grown from solution.