

# 9<sup>th</sup> International Workshop on Electrodeposited Nanostructures

## Growth mechanisms of functional nanowire based architectures

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In recent years, many endeavors were dedicated to the fabrication of functional nanostructured materials with regular organization or new designs. Among recent developments, the combination of controlled electrochemical deposition (ECD) and lithography processes is a promising approach which enables the elaboration of a variety of nanostructured materials with enhanced chemical and/or physical properties.

Two specific natural lithography processes have mainly been used and combined to ECD to achieve organized nanostructure networks. On the one hand, the on-film self-organization of polystyrene nanosphere monolayer was used to produce either masks or template materials. The use of masks allowed the fabrication of ordered 0D and 1D nanostructure arrays by different mechanisms. The use of templates offered a new substrate geometry which enabled the formation of urchin-like ZnO nanostructure array. On the other hand, 1D nanostructure arrays were carried out by template synthesis using anodic aluminum oxide or polycarbonate membranes. More specifically, the electrodeposition mechanism of nanotubes has been studied and cobalt stacked nanotubes and nanowires were achieved. In addition, bismuth telluride nanowire processing has been optimized in order to get high filling ratio of nanopores and homogeneous composition all along the nanowire length [3]. Bismuth telluride nanowire arrays are attracting for their potential use in high efficiency thermoelectric microdevices.

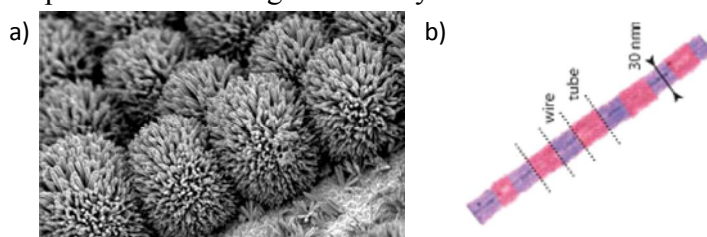


Figure 1: (a) SEM image of an array of hollow well-ordered ZnO urchins [1]; (b) STEM image of a periodically stacked tube-wire structure obtained by potential sweep during the process [2].

### References:

- [1] J. Elias, L. Philippe, J. Michler, C. Levy-Clement, "Mechanism of formation of urchin-like ZnO", *Electrochimica Acta* **56** (26), 9532-9536 (2011)
- [2] L. Philippe, J. Michler, "A kinetic model enabling controlled electrosynthesis of stacked metallic nanotubes and nanowires", *Small* **4** (7), 904-907 (2008)
- [3] C. Frantz et al., "Electrodeposition of bismuth telluride nanowires with controlled composition in polycarbonate membranes" *Electrochimica Acta* **69**, 30-37 (2012)