Low-cost and high throughput synthesis of ZnO nanostars for Energy Storage applications.

G. Di Mari (1,2), G Mineo (1,2), V. Strano (2), G. Malandrino (3), G. Franzò (2), S. Mirabella (1,2), E. Bruno (1,2)

(1) Dipartimento di Fisica e Astronomia "E. Majorana", Università degli Studi di Catania, Via S. Sofia 64, I-95123, Catania, Italy;
(2) CNR-IMM, Via S. Sofia 64, I-95123, Catania, Italy.
(3) Dipartimento di Scienze Chimiche, Università degli Studi di Catania, INSTM UdR Catania, Viale A. Doria 6, I-95125, Catania, Italy

Transition metal oxides (TMO) lead to an innovative direction for the development of materials for electrochemical energy storage due to their excellent stability. Zinc oxide (ZnO), a primary TMO, represents a green choice due to its abundance and biocompatibility. Surface modification and structural design represent the most traveled ways to improve the conductivity of zinc oxides-based electrodes. Indeed, nanostructures with many different shapes have been produced by both sophisticated and costly techniques as well as by means of cheap methods [1].

Here we focus on a cost-effective mass production of nanostars by means of Chemical Bath Deposition (CBD) in aqueous solution. Nanostars appear as 2D self-assembled bundles of crystalline ZnO nanostrips (sized 100 up to 1000 nm), with clear hexagonal symmetry on the assembly plane (building 6-point stars). These novel nanostructures are deeply characterized by X-Ray diffraction (XRD), Scanning Electron Microscopy (SEM), Photoluminescence spectroscopy (PL) and electrochemical measurements (e.g CV, GCD), in order to evidence their structural, morphological, optical and electrical properties. The different preparative parameters, such as concentrations, thermal annealing and reaction time (growth kinetic) were deeply investigated. Specifically, with the kinetic nanostars with different arm lengths (range 80 nm up to 12 μm) have been obtained.

We then tested and optimized the stars with different dimension as capacitors for Energy Storage applications.

[1] Najib, S., Bakan, F., Abdullayeva, N., Bahariqushchi, R., Kasap, S., Franzò, G., Sankir, M., Sankir, N.D., Mirabella, S. and Erdem, E., 2020. *Nanoscale*, 2020, DOI: 10.1039/D0NR03921G