Functional applications ZnO tetrapod nanomaterials made by flame transport synthesis

Yogendra Kumar Mishra, Leonard Siebert, Fabian Schütt, Florian Ceynowa, Mona Mintken, Sindu Shree, Daria Smazna, Ingo Paulowicz, Oleg Lupan, Sören Kaps, Rainer Adelung

Functional Nanomaterials, Institute for Materials Science, Kiel University, Kaiserstr. 2, D-24143, Kiel, GERMANY

Contact: ykm@tf.uni-kiel.de

Abstract

Applications of ZnO tetrapods in: (i) Nanoelectronics, (ii) Optics, (iii) Advanced Composites, (iv) Sensing, (v) 3D Nanocarbons, (vi) Biomedical, and in many other directions [1-10] will be briefly presented in this talk.

Zinc oxide (ZnO) material with n-type conductivity, wide bandgap of ~3.37 eV, hexagonal-wurtzite crystal structure, has been among one of the most pioneering materials towards nanostructuring and broad range of applications [1]. A wide variety of nanostructural shapes from ZnO have been synthesized and utilized for many applications but the role of structural aspects, such as complex shape, still needs to be addressed. Inspired by unique capabilities of ZnO, we recently developed a flame based nanostructuring process, called flame transport synthesis, which offers very simple and mass-scale fabrication of tetrapod shaped ZnO structures. The 3D shape feature enables these tetrapods to be used as unique building blocks for fabricating highly porous and flexible ceramic materials for advanced technologies. They can be used as backbones/templates for synthesizing hybrid and new 3D porous nanomaterials [1-10]. The applications and nanostructuring opportunities by flame approach are briefed in Figure 1.

The presentation will highlight:

- Scopes of ZnO nanomaterials towards various applications.
- Nanostructuring by flame transport synthesis approach.
- Importance of tetrapod and other complex shapes towards applications.
- Highly porous 3D nanomaterials as flexible ceramic materials.
- Template based nanostructuring for new 3D nanomaterials.

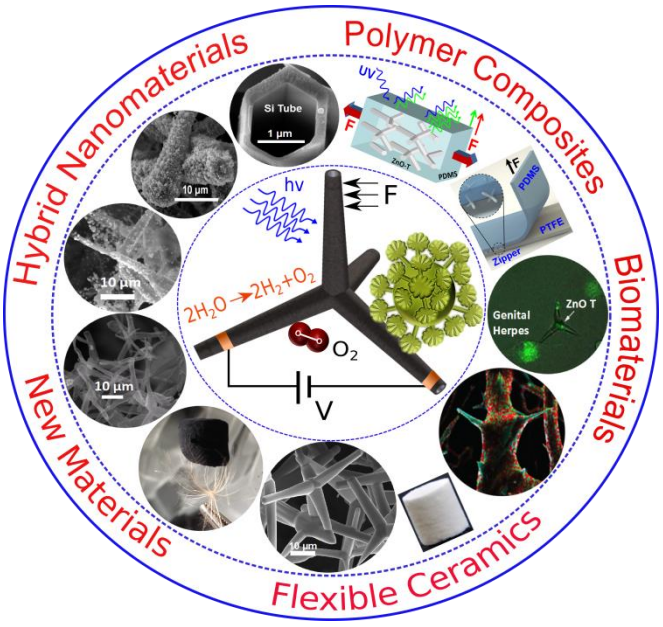

Figure 1: Application scopes of ZnO tetrapod shaped nanostructures in various directions.

References

[1] Materials Today **2018** (DOI: 10.1016/j.mattod.2017.11.003).
[2] Nature Comm. **2017**, 8, 1215.
[3] Nano Letters **2017**, 17, 6235-6240.
[4] Adv. Funct. Mater. 27, **2017**, 1604676.
[5] J. Immunology 196, **2016**, 4566-4575.
[6] ACS Appl. Mater. Interfaces 7, **2015**, 14303–14316.
[7] Adv. Mater. 26, **2014**, 1541-1550.
[8] Adv. Mater. 25, **2013**, 1342-1347.
[9] Particle & Particle Systems Characterization 30, **2013**, 775-783.
[10] Adv. Mater. 24, **2012**, 3486-3490.