

Interface-dominated hybrid 3D nanoarchitectures with tailored optoelectronic properties

**Specially designed 2D, large area 3D and single nanostructure HIOS
monitored by optoelectrical measurements**

3D-HIOS (Diodes, Solar cells, Transistors)

Si, GaN
+
Conjugated polymers
and
inter-molecules
+
Plasmonic structures

Experimental monitoring and validation of
charge generation, transfer and extraction processes in HIOS



Device characterization

CV-profiling (band alignment, interface recombination)
(illuminated-) IV, EQE, IQE (charge transfer and extraction)

SEM-insitu nano characterisation methods

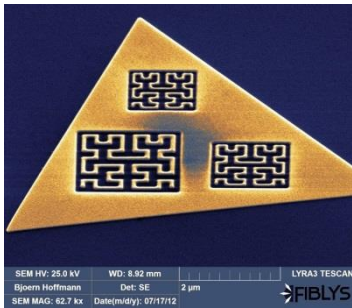
4-point nanoprobng, EBIC, Raman, CL, PL
HIM (especially suitable for visualizing organics)



Optoelectronic simulations and fabrication
of photonic and plasmonic structures and of devices

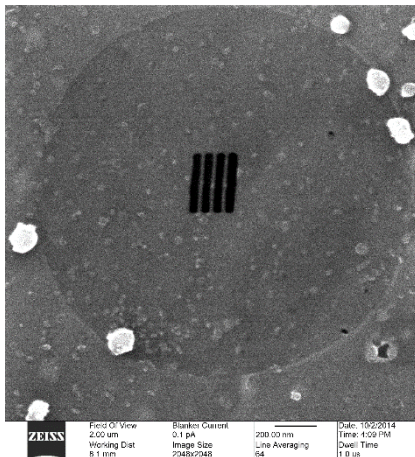
Nanostructured materials: Plasmonic nanostructures

- Hybrid: **Alumina** resonator (EBL) to enhance Raman Signal of **Graphene**
- Gold** (solution processed flakes) + FIB



M. Bashouti, B. Hoffmann, to be submitted

- Graphene** (Zeiss HIM)



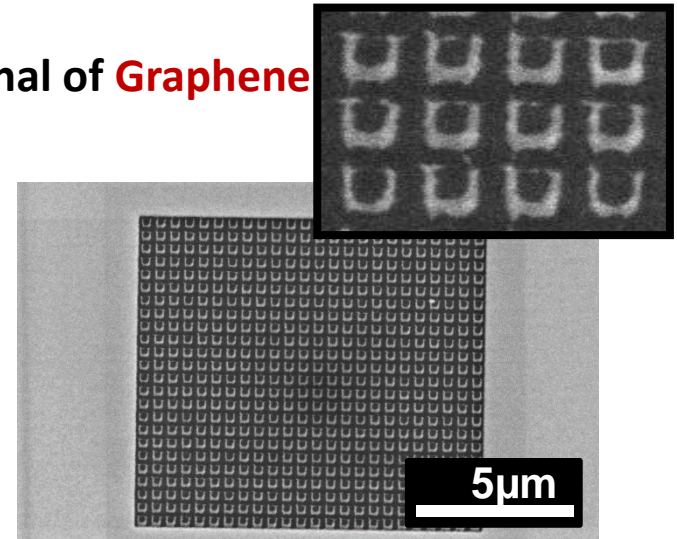
K. Höflich, unpublished

- Gold** (direct writing EBID)



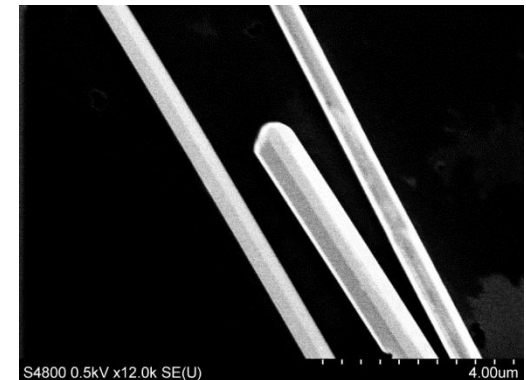
K. Höflich et al, Adv. Mat. 23, 2657 (2011)

- Degenerated **Al:ZnO** by ALD



G. Sarau et al, Adv. Opt. Mater. 1, 151 (2013).

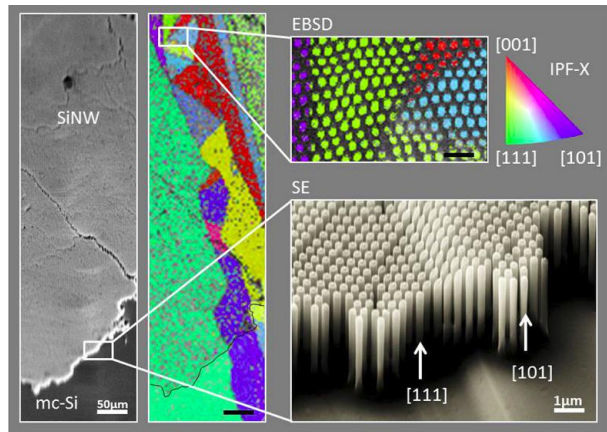
- Silver** (solution processed wires)



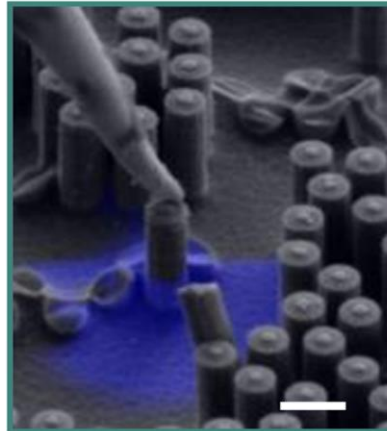
M. Bashouti, unpublished

Nanostructured materials: Semiconducting nanowires

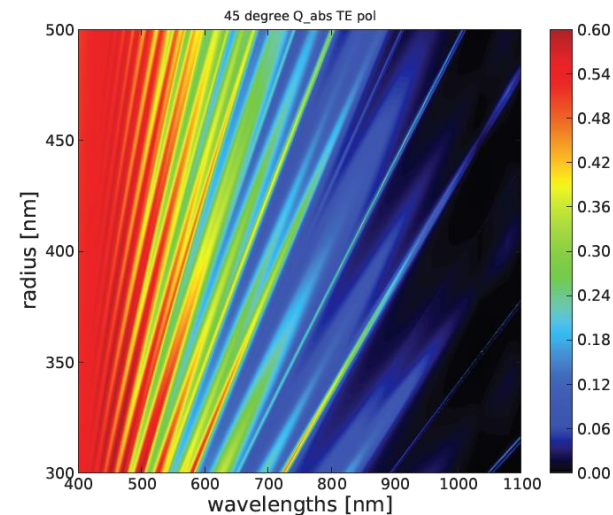
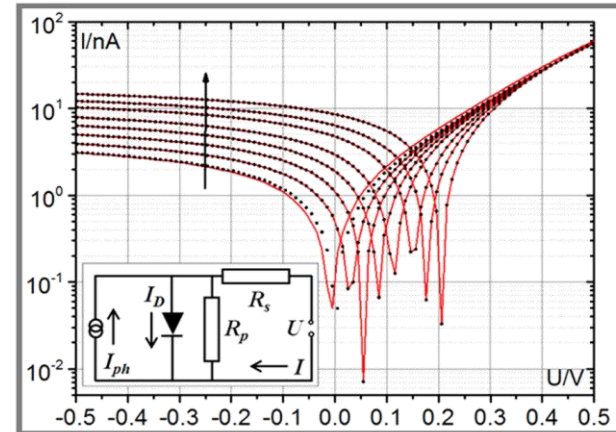
- Silicon:** nanosphere lithography (NSL)+ reactive ion etching (RIE)



S. Schmitt et al, Nano Lett. 12, 4050 (2012).

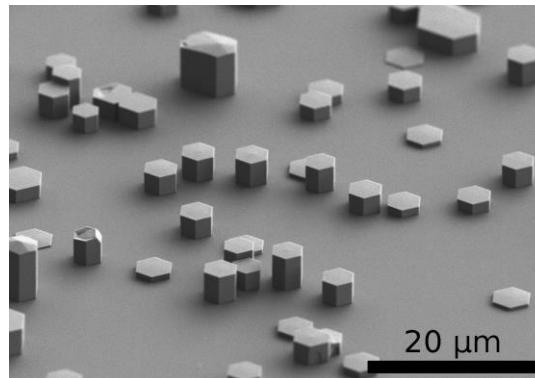


S. W. Schmitt et al, Nanoscale 6, 7897 (2014).

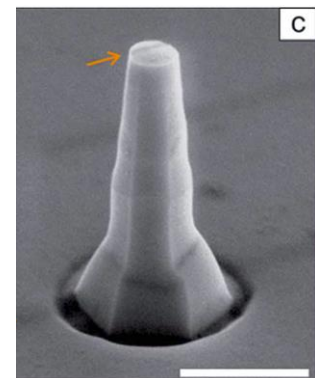


G. Brönstrup et al, ACS Nano 4, 7113 (2010).

- GaN:** self assembled MOVPE
- InGaN/GaN:** NSL + RIE



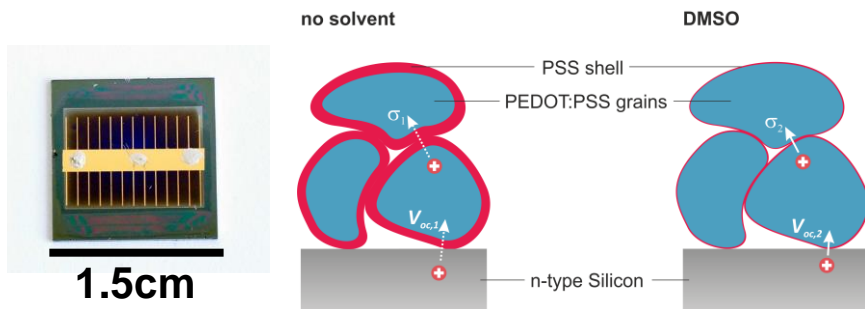
C. Tessarek et al, Optics Express, 21, 2733 (2013)



G. Sarau et al, Nanoscale 6, 11953 (2014)

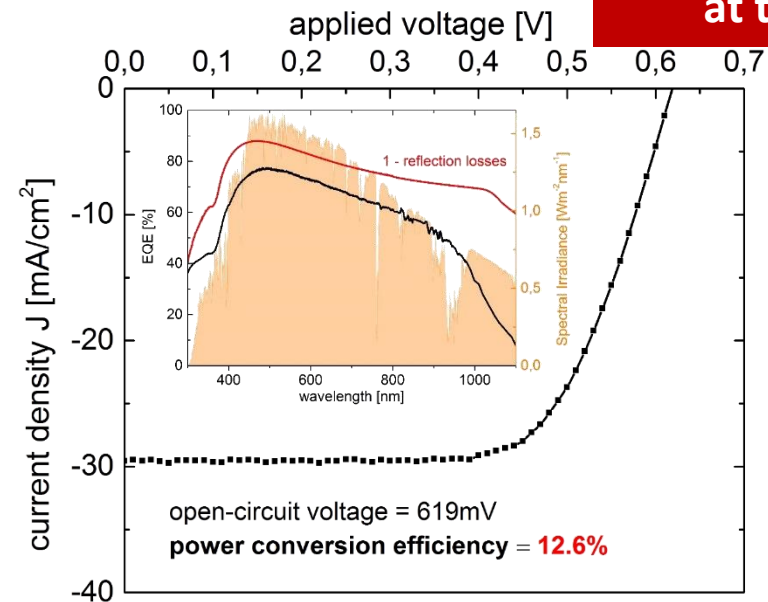
Preliminary work: hybrid optoelectronic devices

Hybrid solar cells: polythiophene on silicon



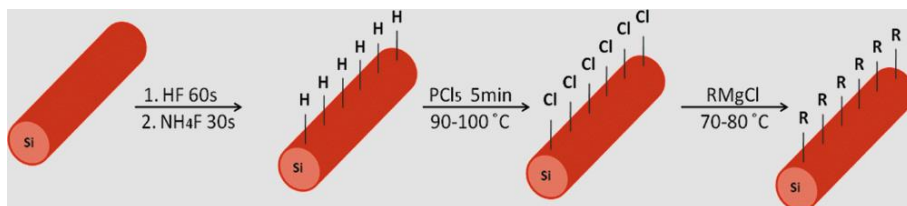
M. Pietsch et al,
J. Phys. Chem. C 117, 9049 (2013)

**Electrically measurable tunable
band alignment
at the hybrid interface**

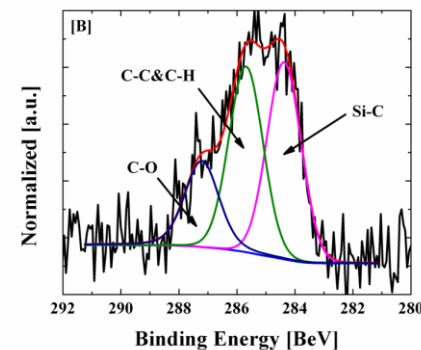
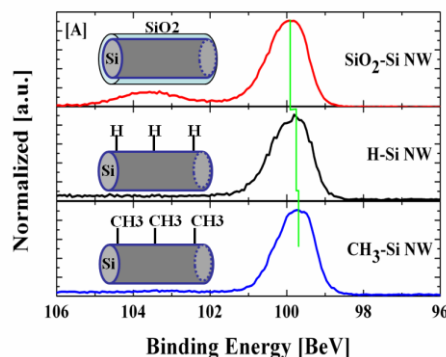


M. Pietsch et al, Appl. Phys. A 115, 1109 (2014)

Functionalization with molecules: silicon nanowires



M. Bashouti et al,
Progr. Surf. Sci., 88, 39 (2013).



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