Temperature stable and optically transparent thin film zinc oxide aerogel electrodes as model-systems for 3-D interpenetrating organic-inorganic heterojunction solar cells.

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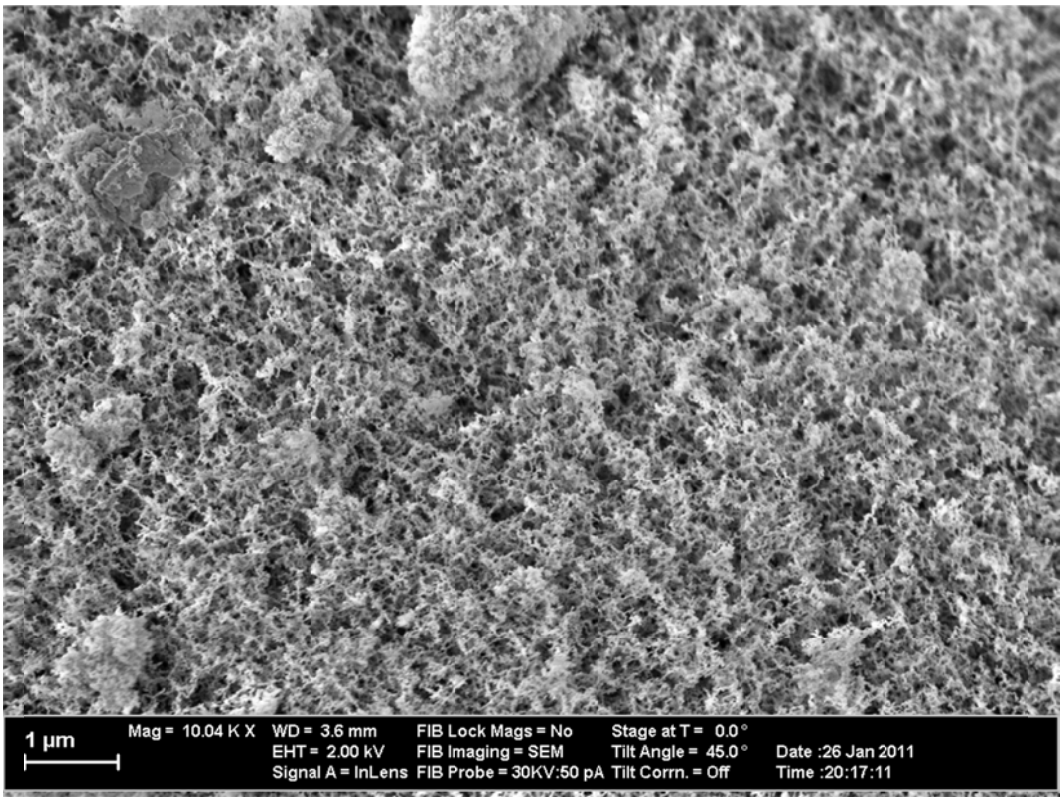
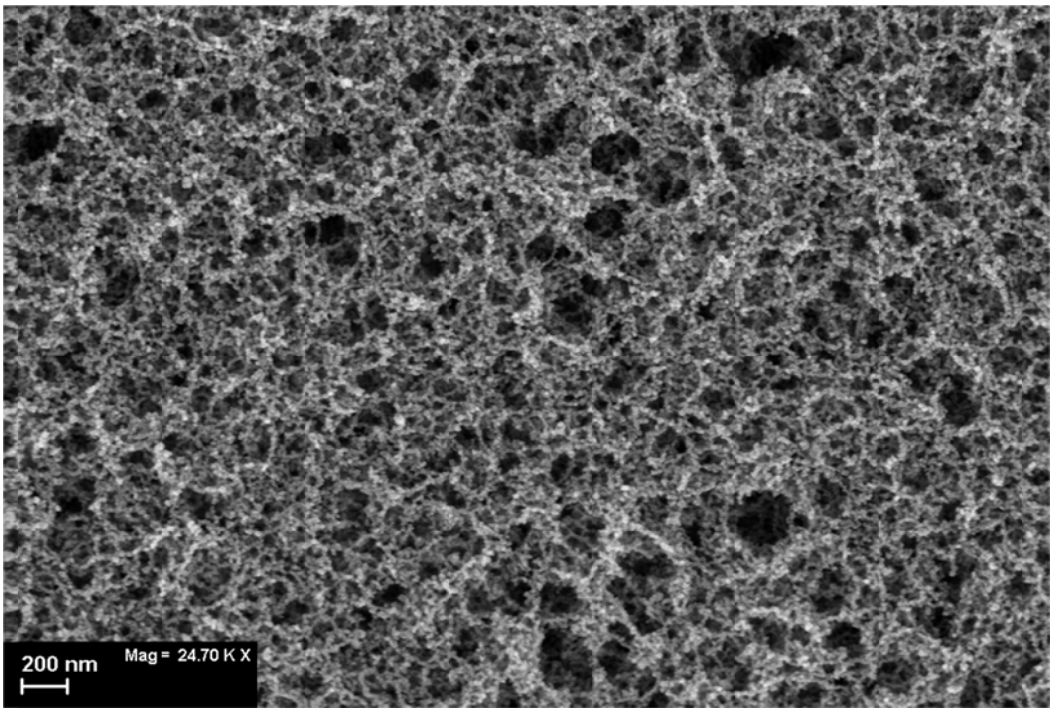
SUPPORTING INFORMATION

SI-1:

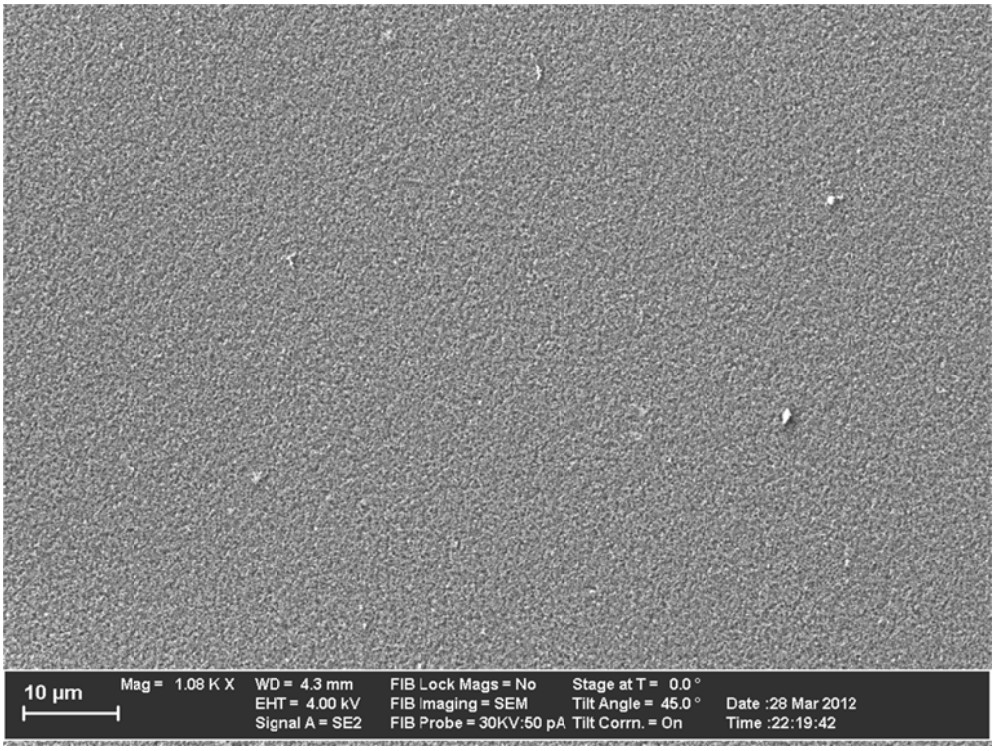
Further electron microscopy data for the thin aerogel films:

SEM - large magnification:

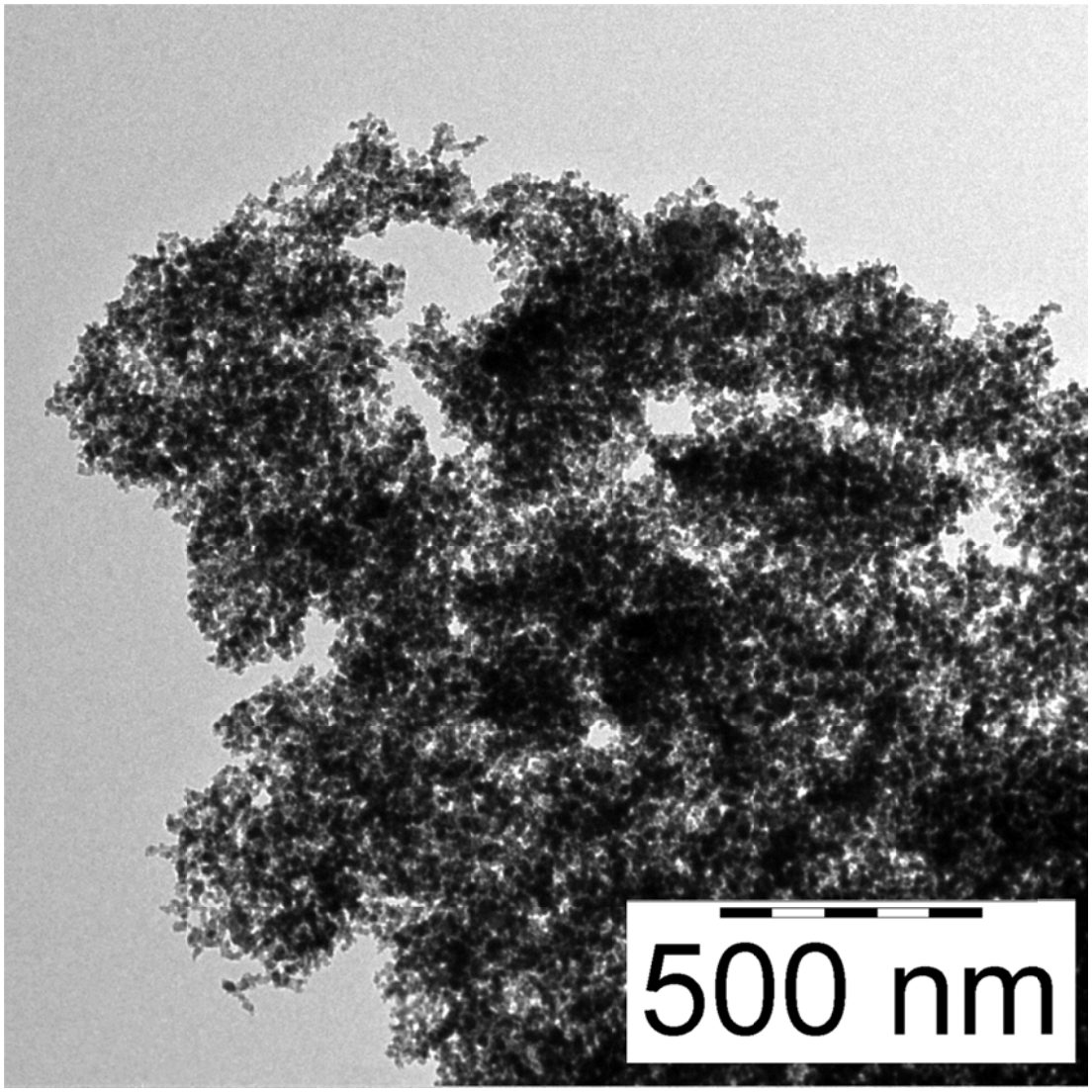


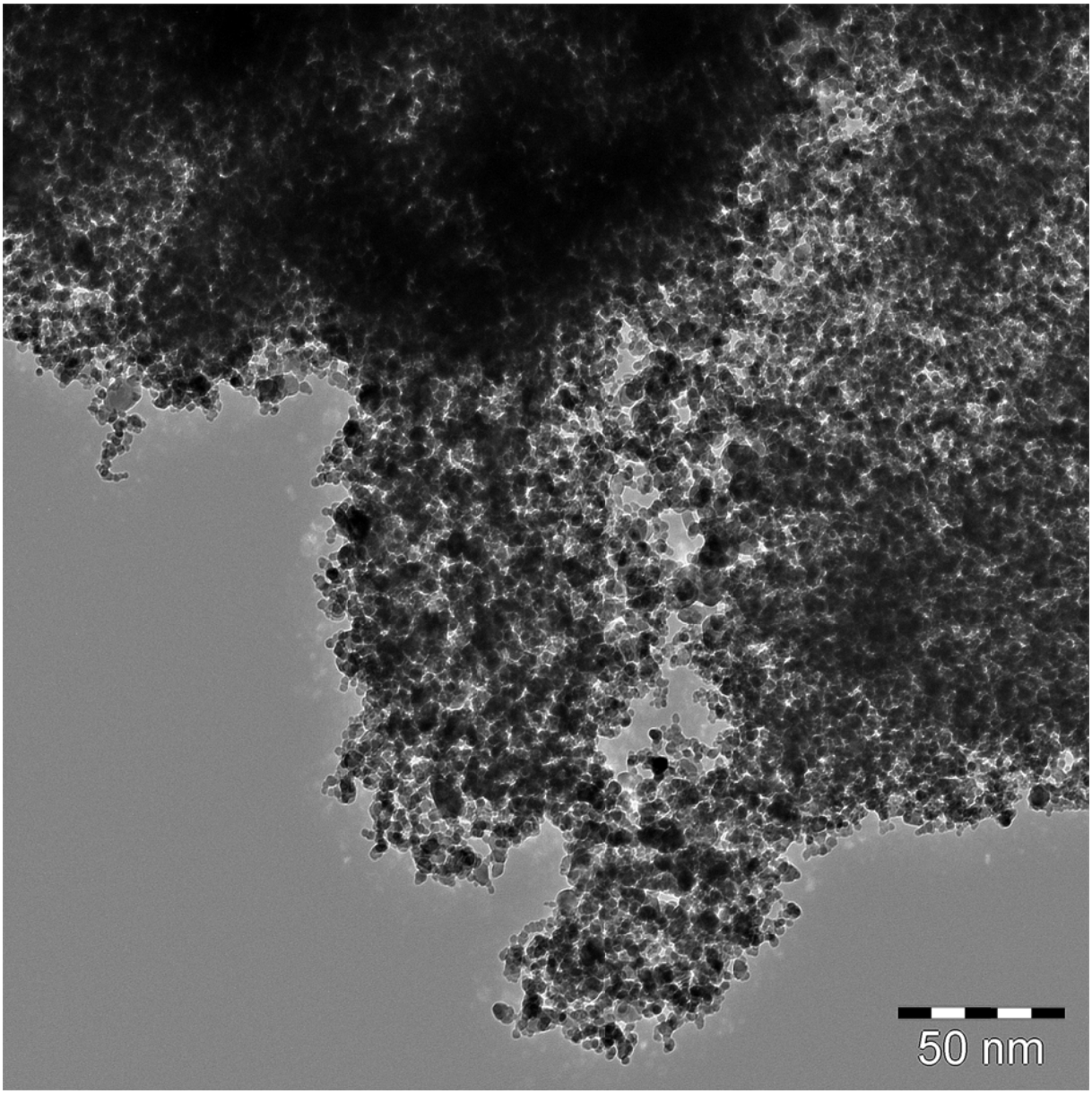


SEM-large area:



TEM:




50 nm

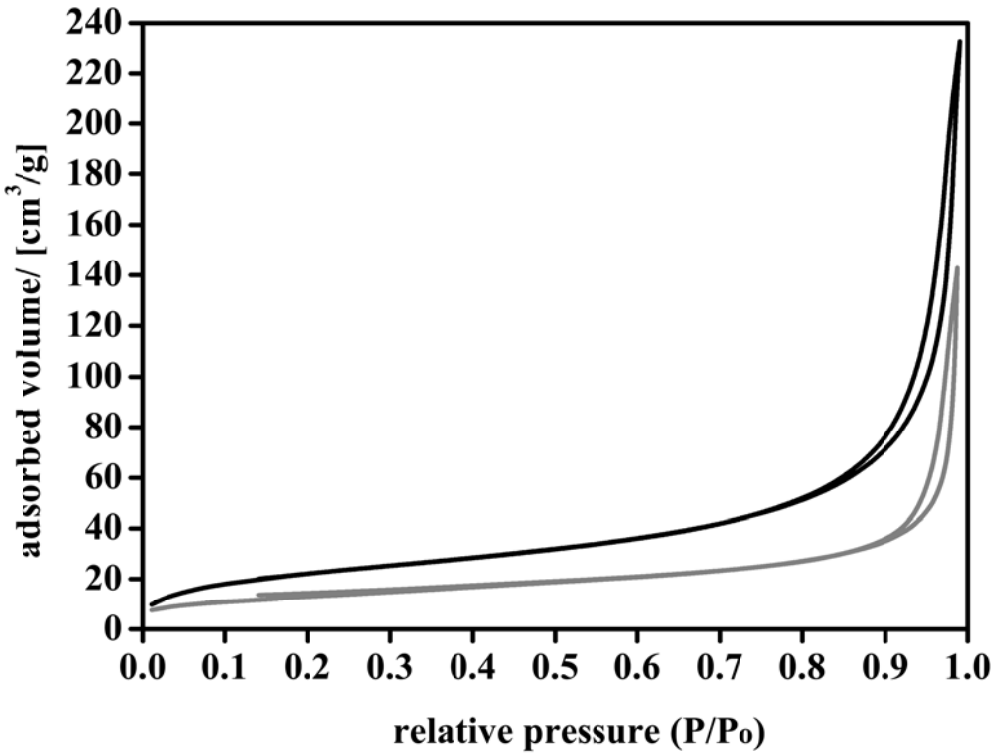
SI-2

Adsorption / Desorption isotherm of aerogel film scratched from glass surface

Adsorption/desorption isotherm of unsintered (solid black line) and sintered (grey line) aerogel film.

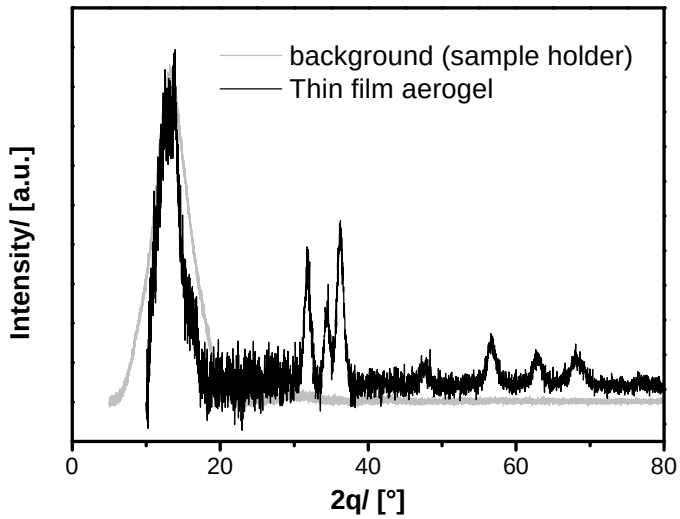
BET surface area unsintered film: 82.70m^2/g

BET surface area sintered film: 46.64m^2/g



SI-3

GI-PXRD data of the thin aerogel films



Entire data range of the thin aerogel films prepared on a glass slide (black graph). Measured in grazing incidence geometry in comparison to the corresponding background signal (grey graph).

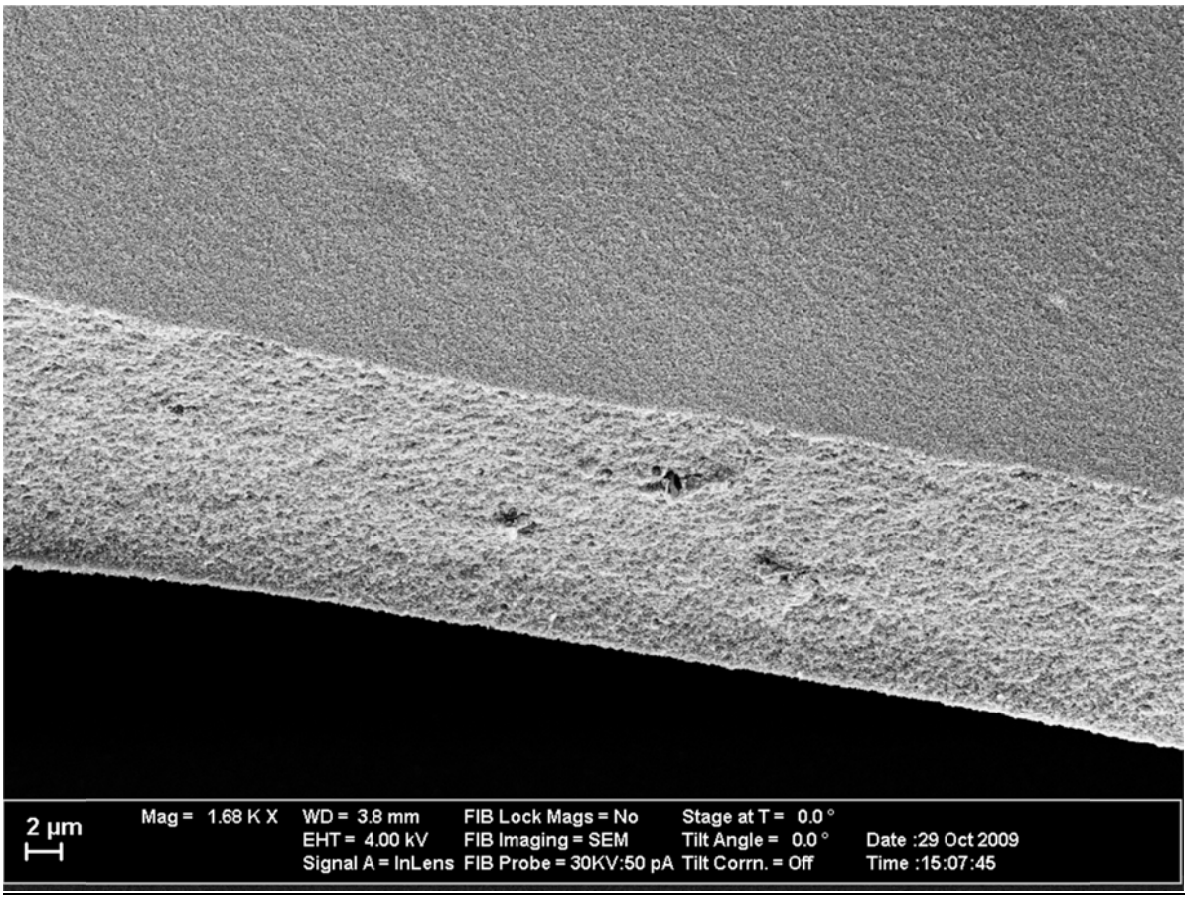
Crystallite size before and after sintering was calculated using the Scherrer equation applied to the (110) reflex of ZnO in the Wurtzite modification. The results are comparable to previously reported full profile analysis using a Le-Bail fit.

Crystallite size before sintering (100°C, 1h): 4.7 nm

Crystallite size after sintering (400°C, 3h): 7.4 nm

SI-4

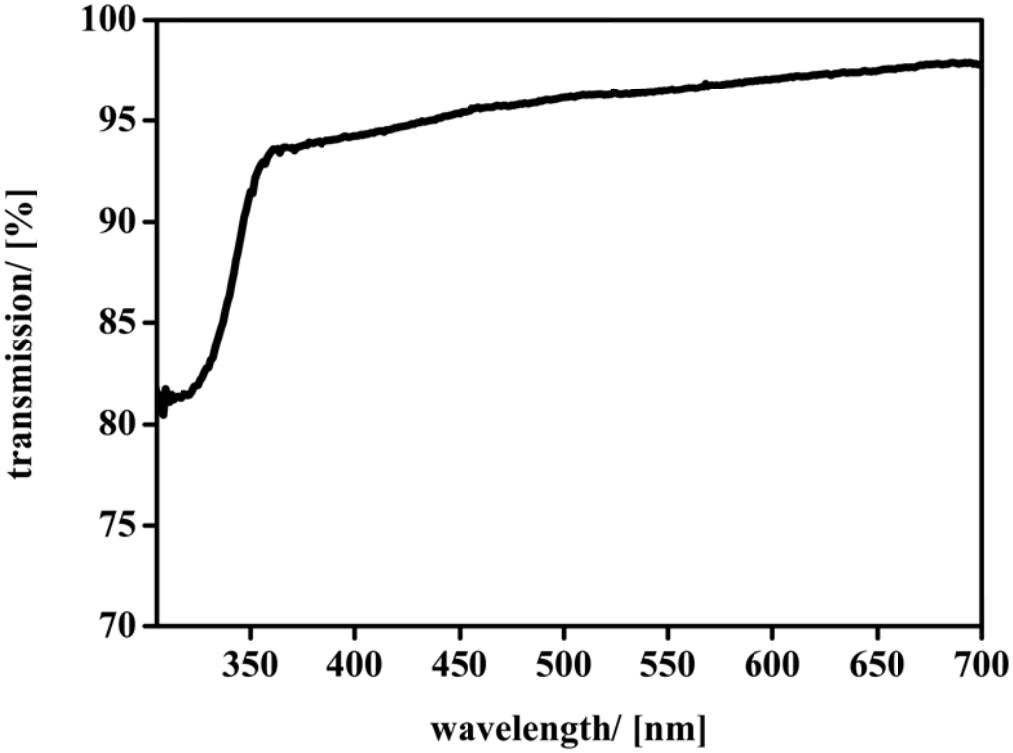
SEM image of a thicker ZnO aerogel film



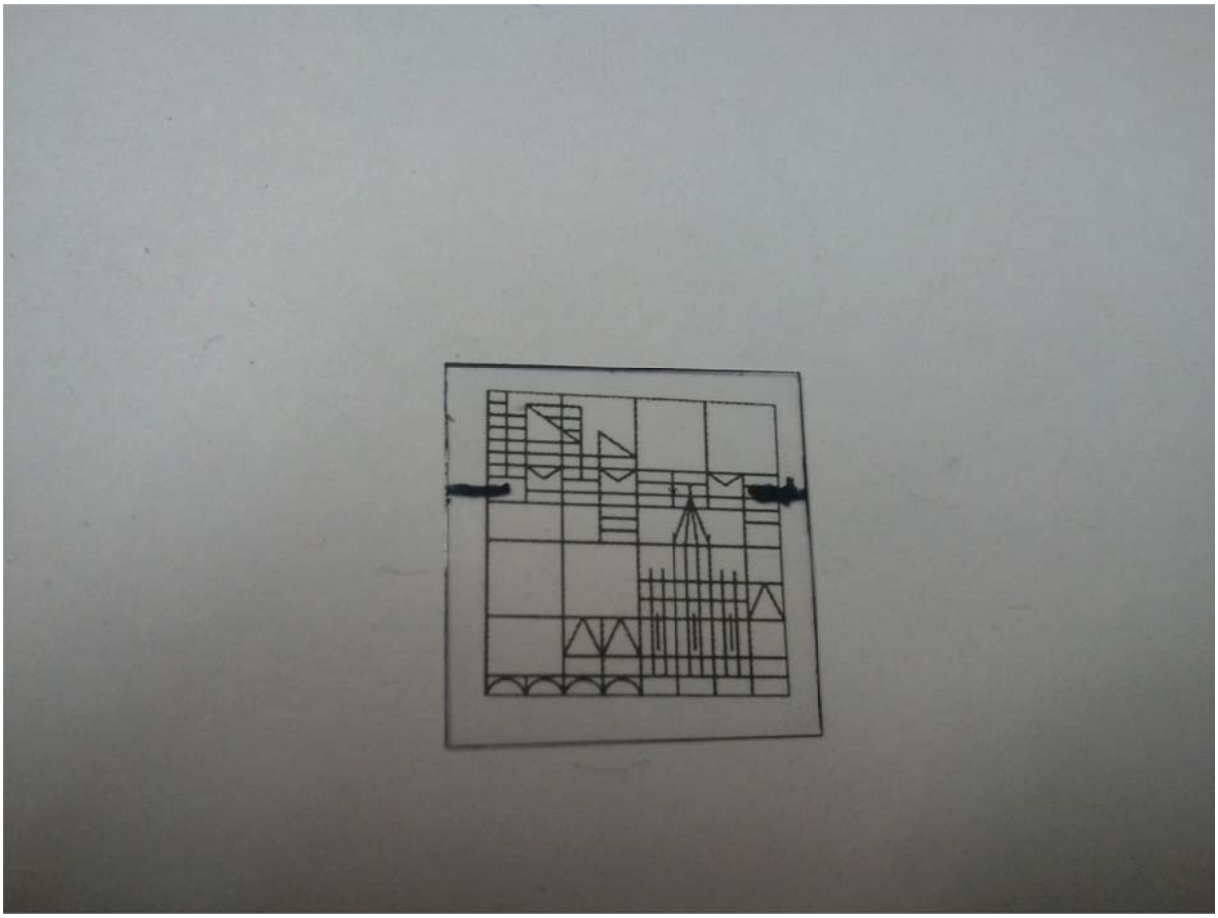
SI-5

Optical properties of the prepared, thin aerogel films.

UV-VIS spectrum of 200nm thick ZnO aerogel measured in transmission:



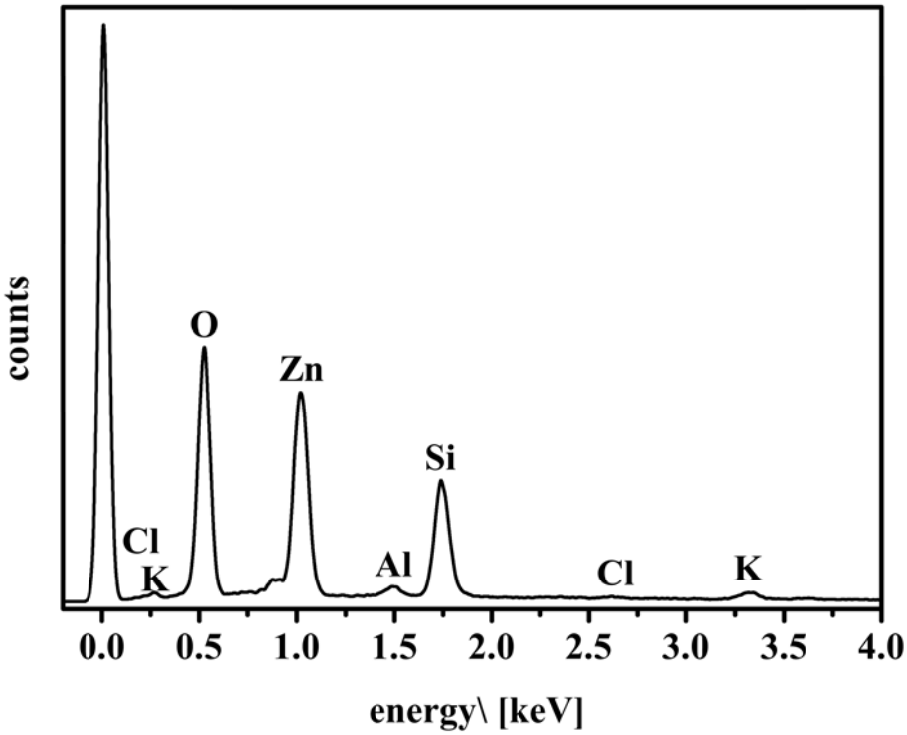
Photographic images:



Glas slide, coated with 200nm ZnO aerogel film from bottom to the marking, laid over the university logo.

SI-6

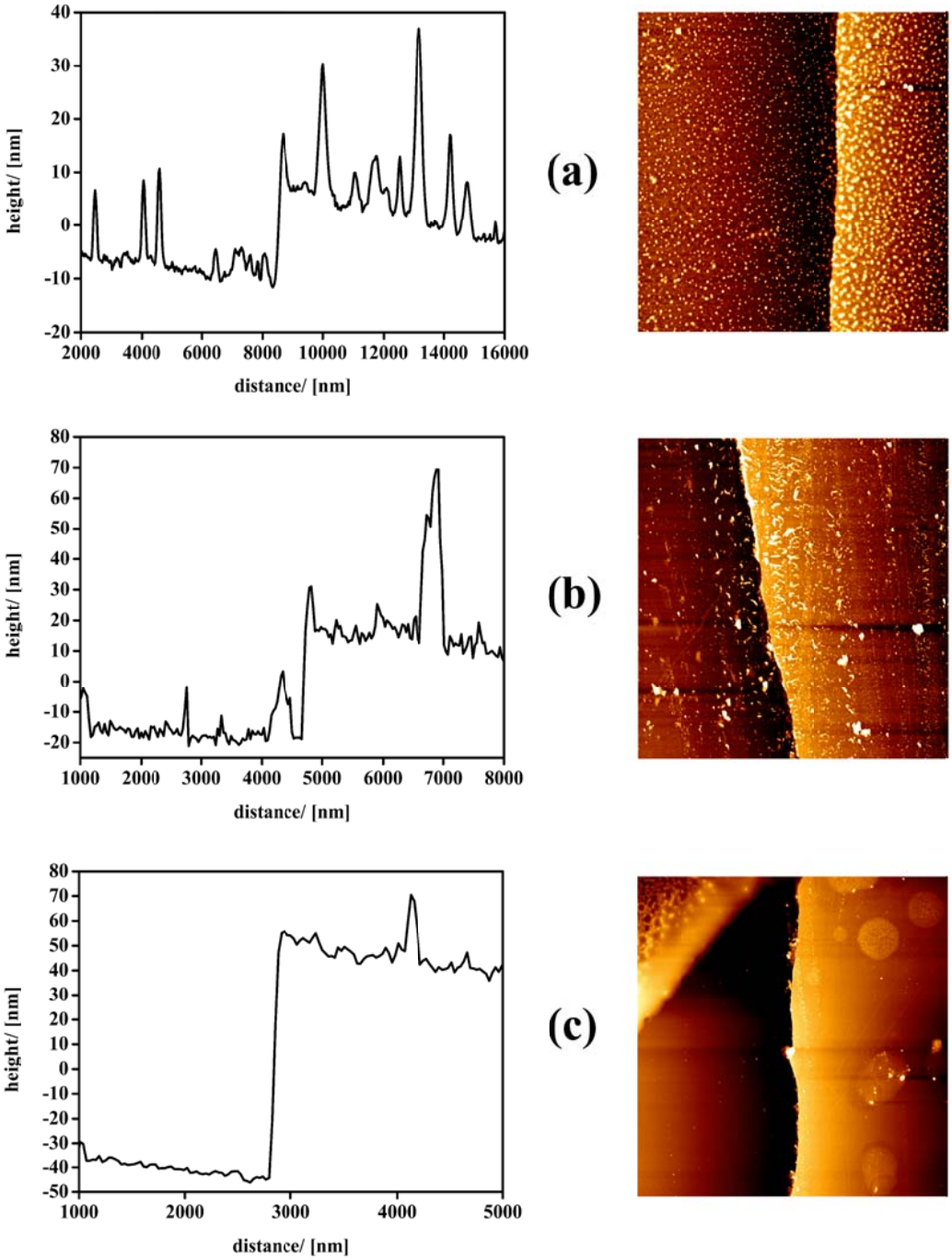
EDX spectrum of the prepared, thin aerogel films.



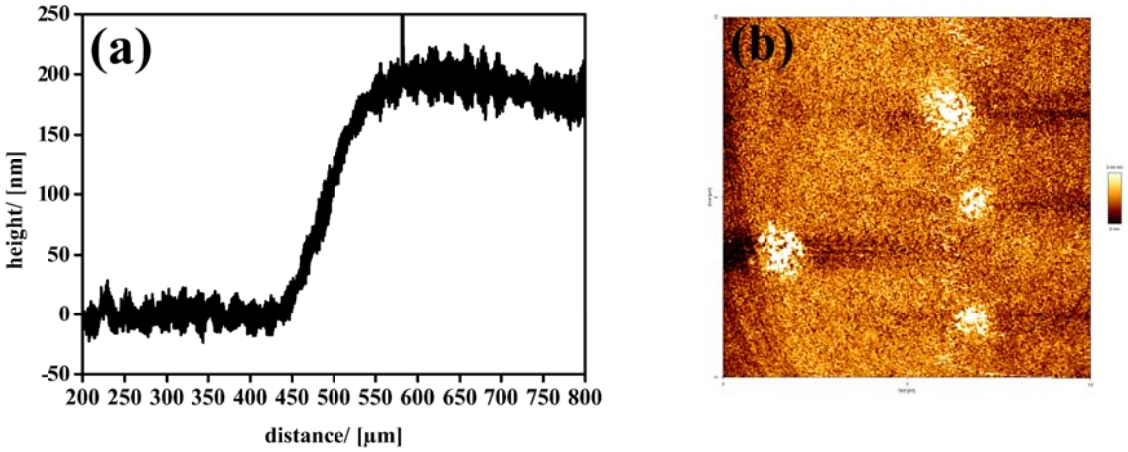
EDX analysis (10keV, high current mode) only shows the ZnO-material and the glas slide on top of which the aerogel was coated. No organic residues can be observed.

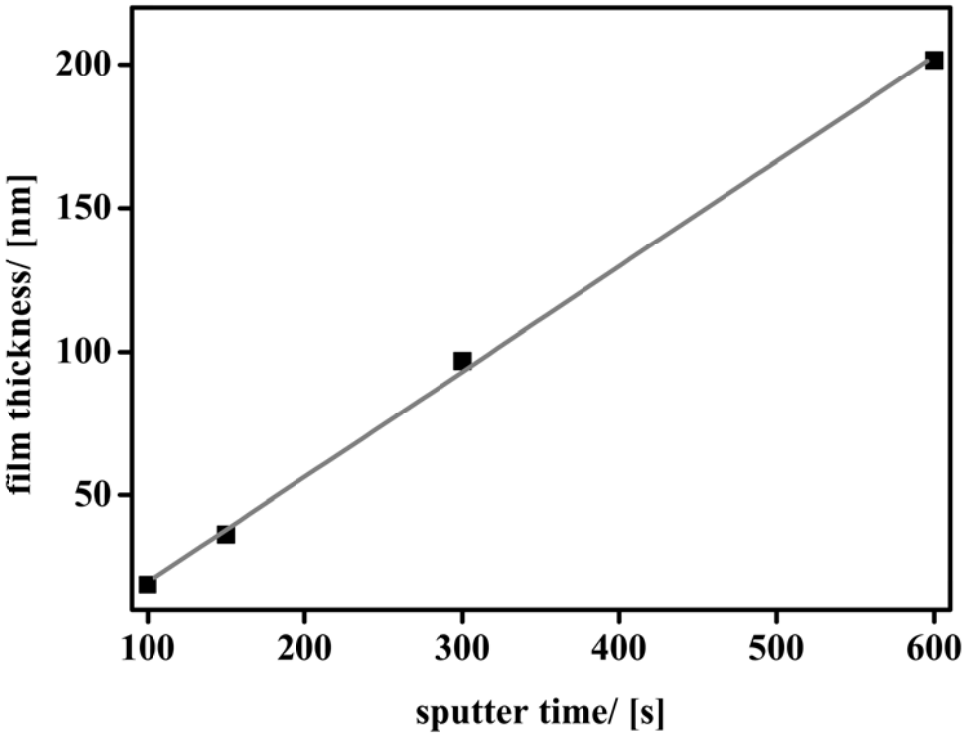
SI-7

AFM height profile (left) and AFM pictures of ZnO protection layer. (a) 100s / 18.9nm, (b) 150s / 36.4nm, (c) 300s / 96.9nm.



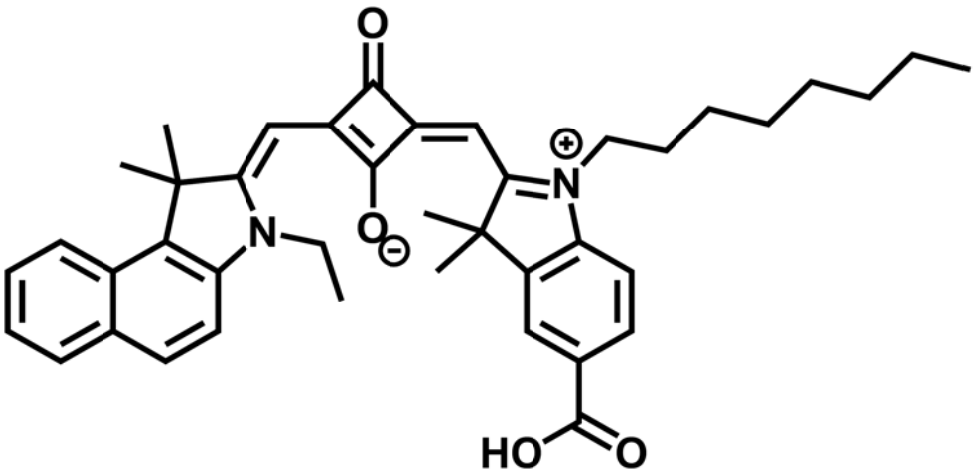
(a) Height analysis with Profilometrie of ZnO protection layer 600s/201.6nm. (b) AFM picture of ~100nm ZnO protection layer to show roughness.





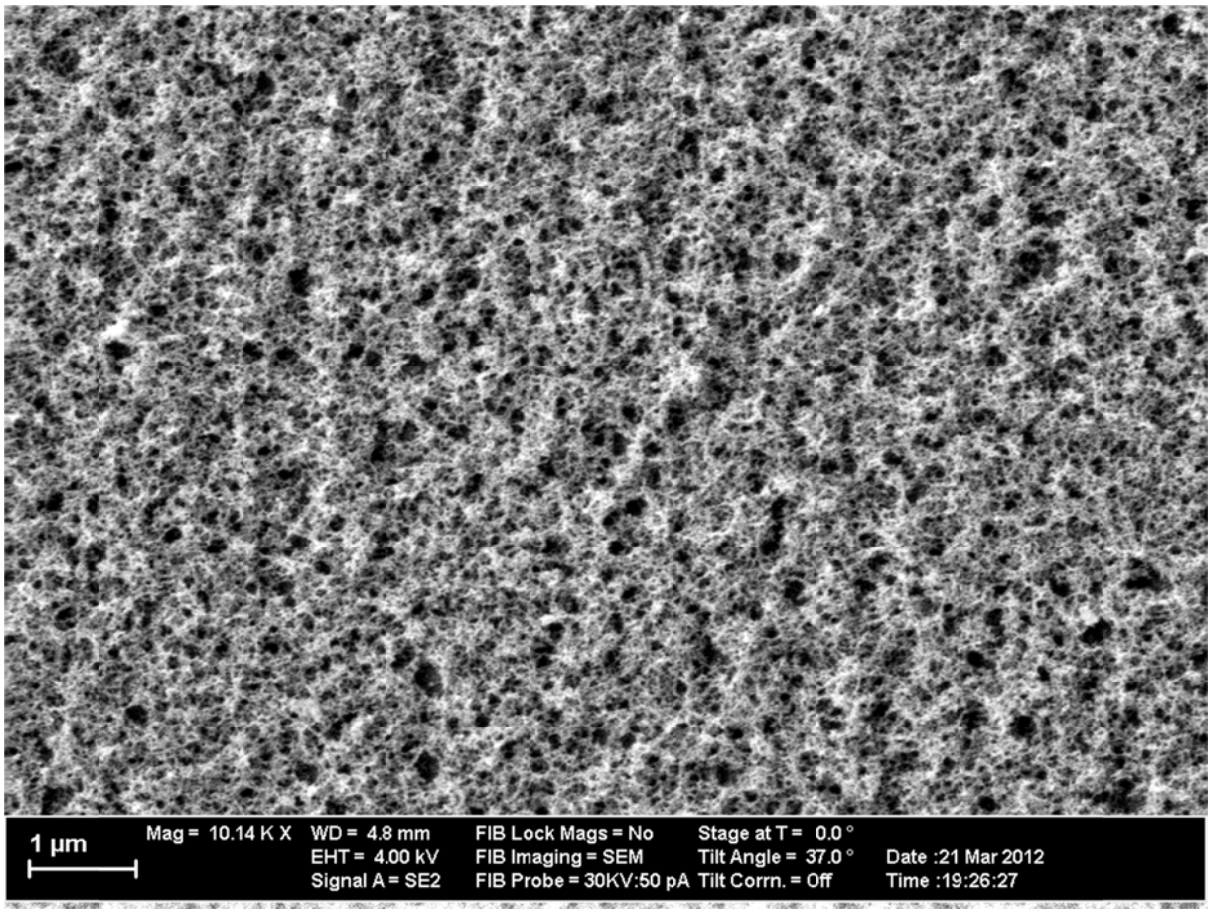
SI-8

(E)-4-((5-carboxy-3,3-dimethyl-1-octyl-3H-indol-1-ium-2-yl)methylene)-2-((Z)-(3-ethyl-1,1-dimethyl-1H-benzo[e]indol-2(3H)-ylidene)methyl)-3-oxocyclobut-1-enolate.



SI-9

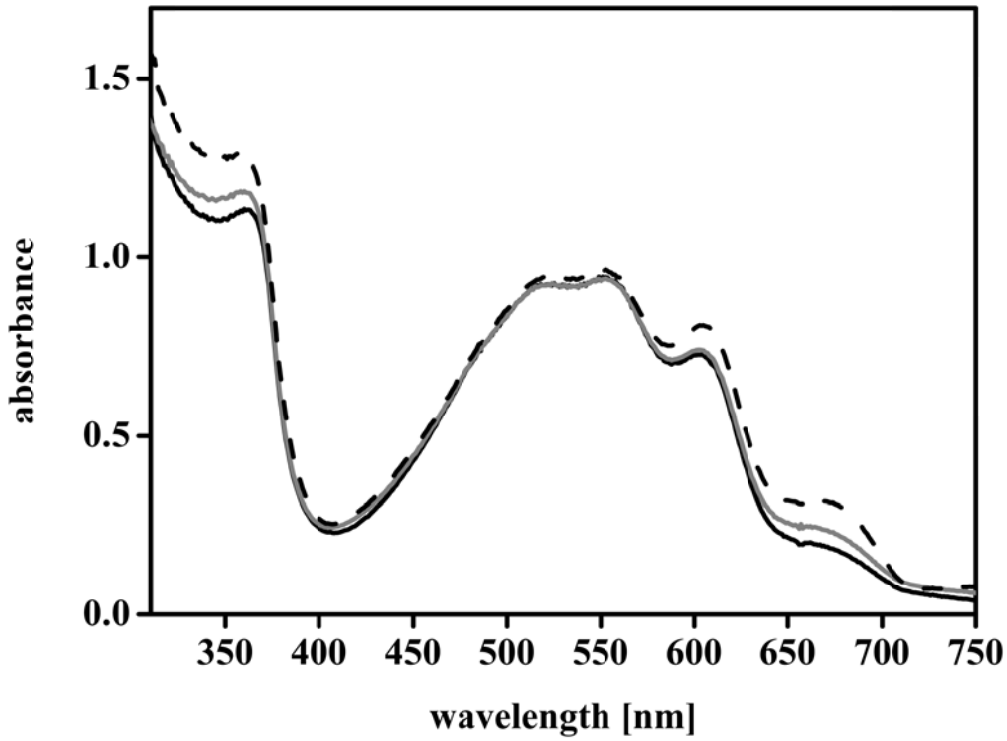
SEM image of the P3HT/ZnO layer after oxidative removal of the polymer.



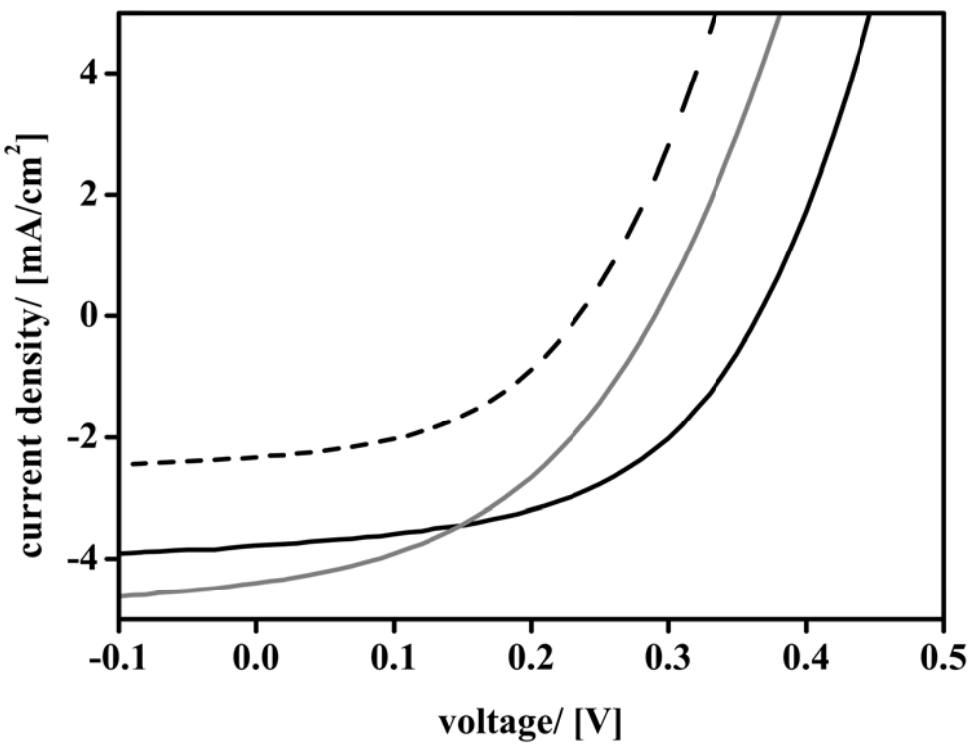
SI-10

UV-Vis spectra of BHJ solar cells with different aerogel film thickness

UV-Vis spectra recorded before the top layer was applied. Thickness of aerogel film ranging from 200nm (black line) over 300nm (grey line) to 500nm (dashed line).



SI-11

Current - voltage characteristic of BHJ solar cells with different aerogel film thickness

Thickness of aerogel film ranging from 200nm (black line) over 300nm (grey line) to 500nm (dashed line).