Tailoring Optical Properties of Sputter-Deposited Au Nanostructures on TiO_2 Templates based on *in situ* GISAXS Determined Growth Laws[1]

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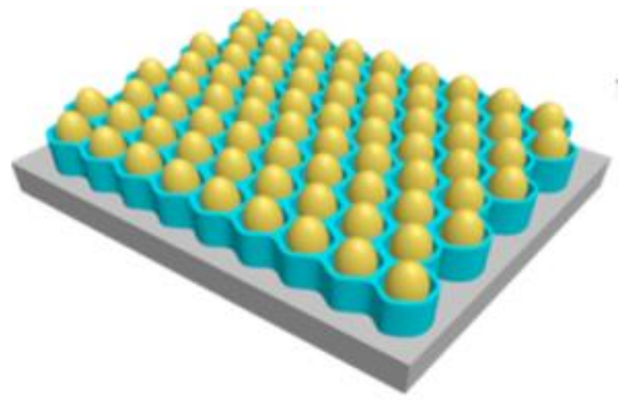
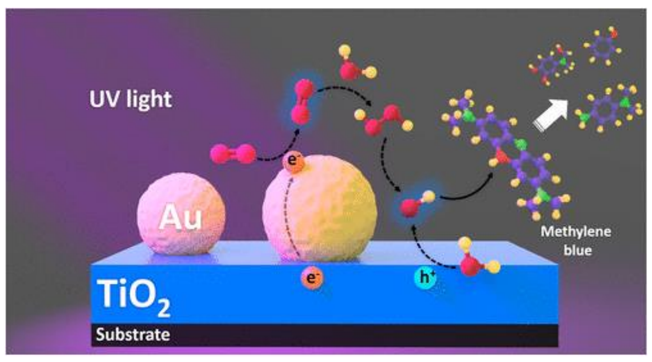
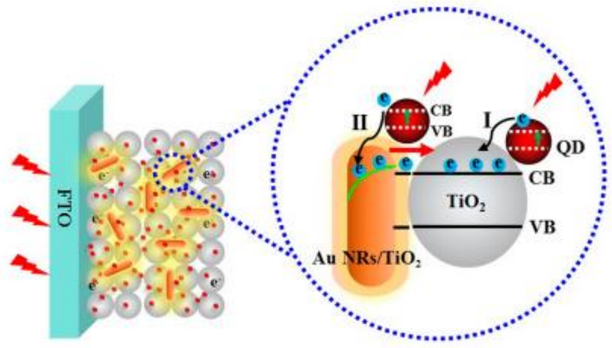
Background & Motivation: Au/TiO_2 hybrid materials for various applications



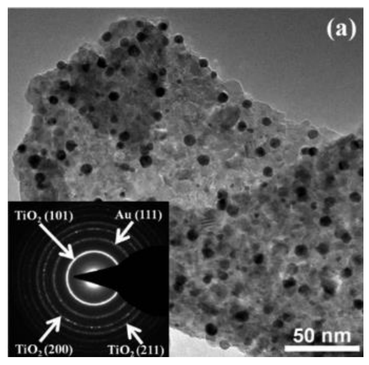
Au/TiO_2 for photoelectrochemical sensor [2]



Au/TiO_2 for photocatalysis [3]

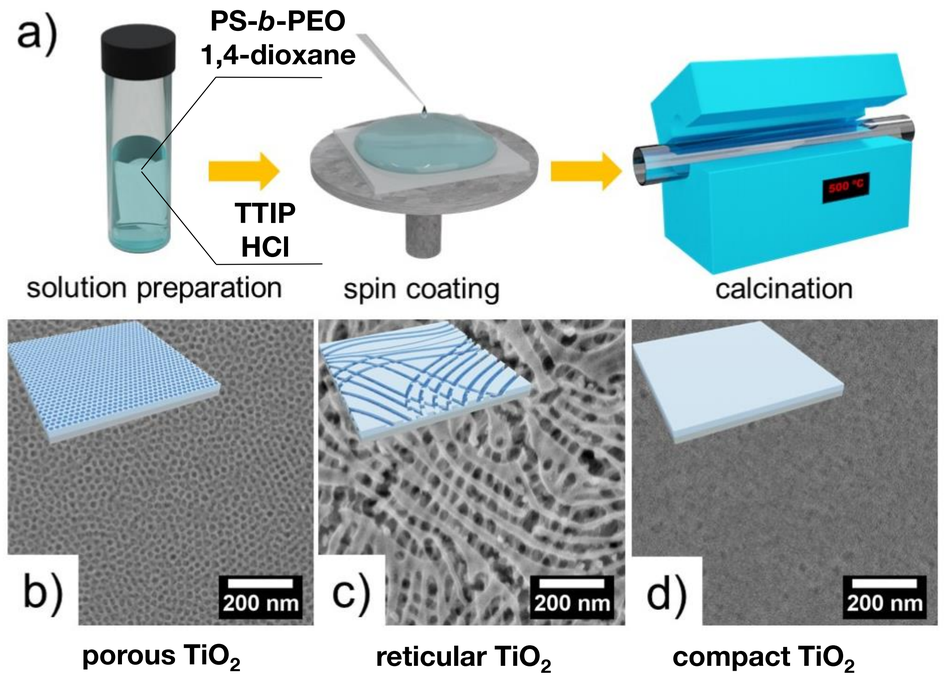


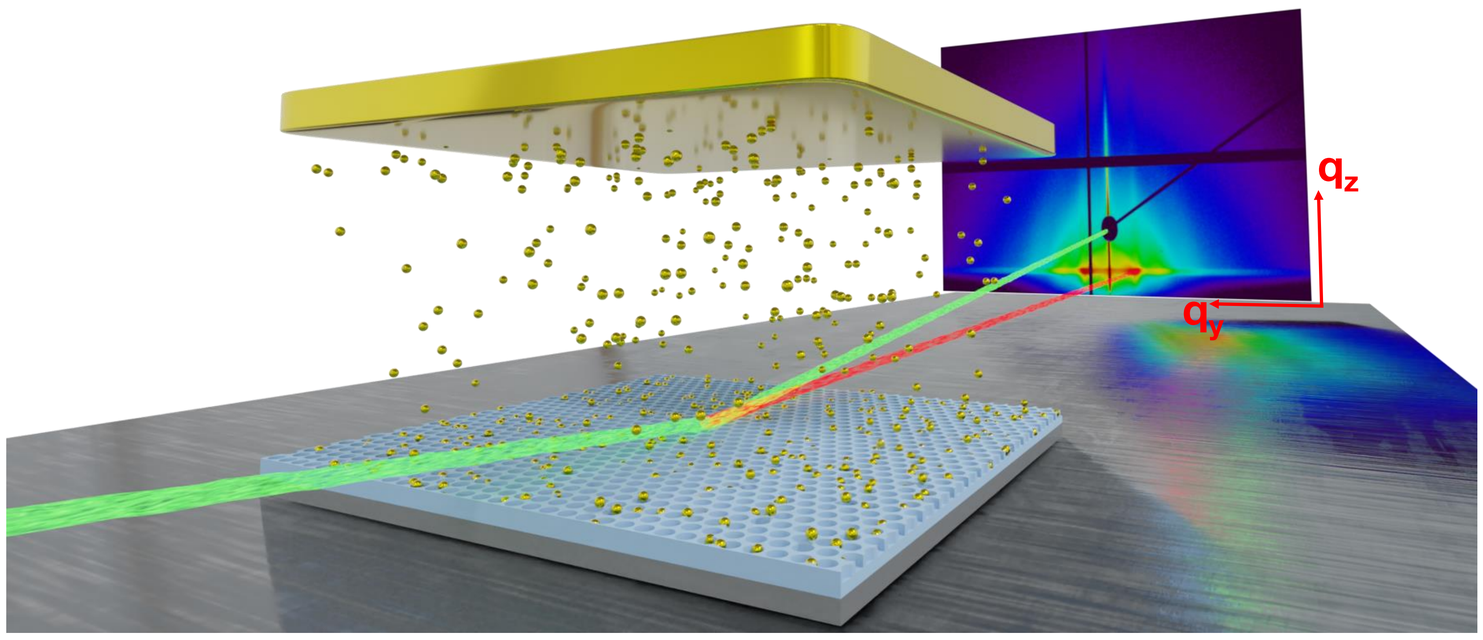
Au nanorod@TiO_2 for solar cell [4]



Au/TiO_2 nanosheet for battery[5]

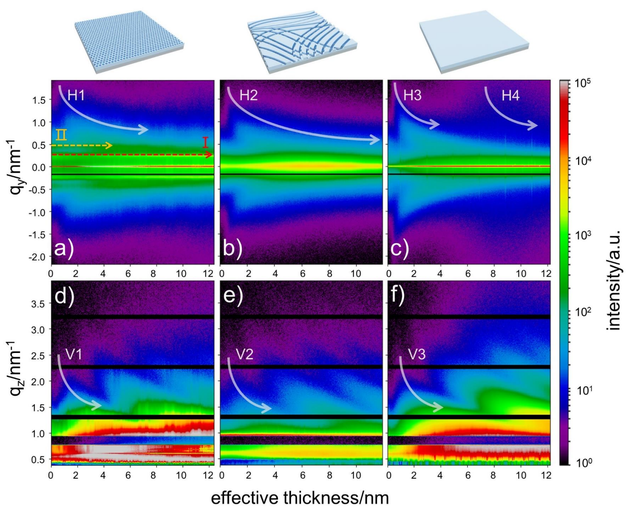
Preparation of TiO_2 templates & sputter deposition with *in situ* GISAXS





Au growth dynamics analysis by *in situ* GISAXS data

Contour plots of horizontal and vertical cuts



Peak H1, H2, H3 refer to the evolution of sputter deposited Au clusters.
Peak I and II indicate the template effect of porous TiO_2 template.
H4 indicates the formation and growth of granular structures with higher orders.
Peak V1, V2, V3 indicate the effective thickness increase of the Au layer.

Modeling of GISAXS data

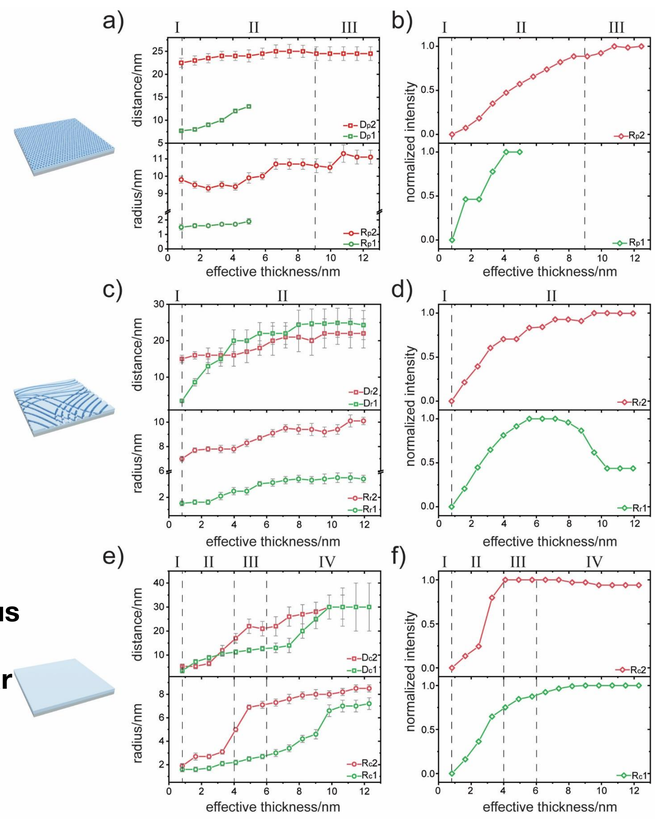
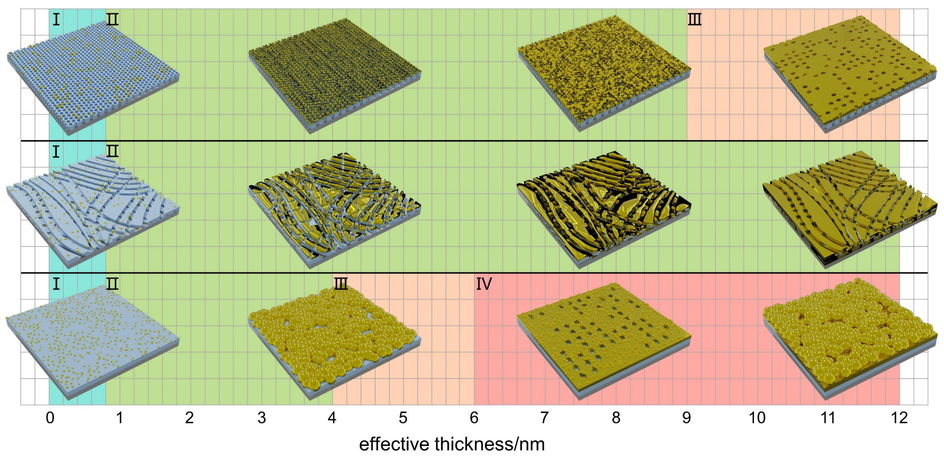


Illustration of the growth stages of sputter-deposited Au on TiO_2 templates



(I) nucleation

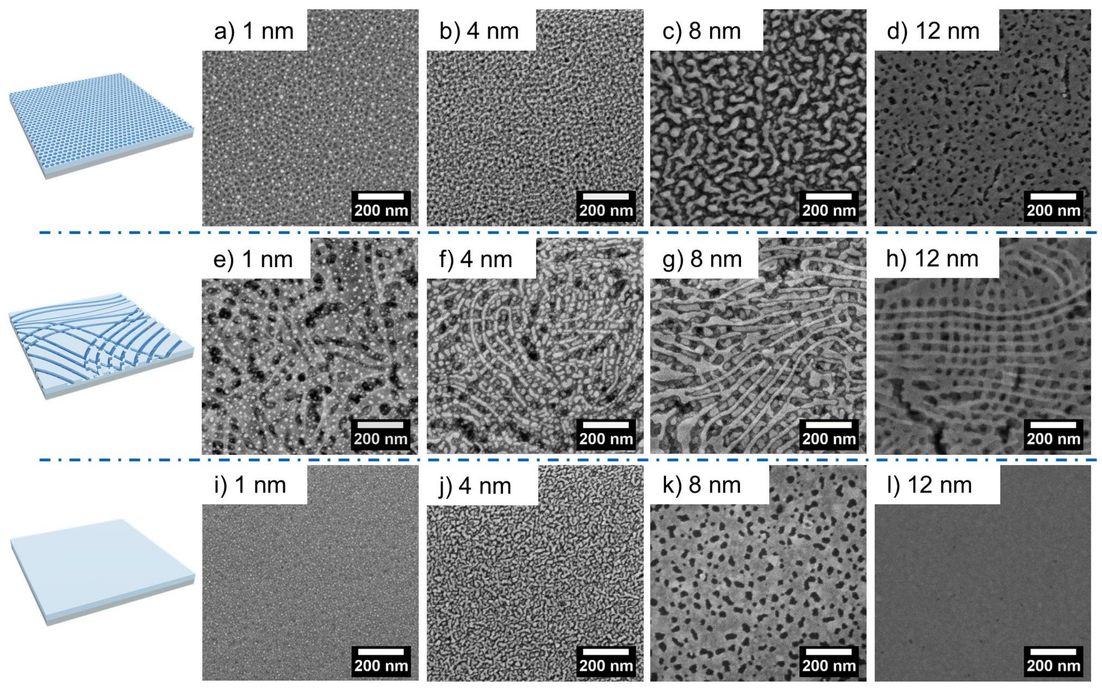
(II) diffusion-mediated coalescence and adsorption-mediated growth

(III) formation of large compact Au regions

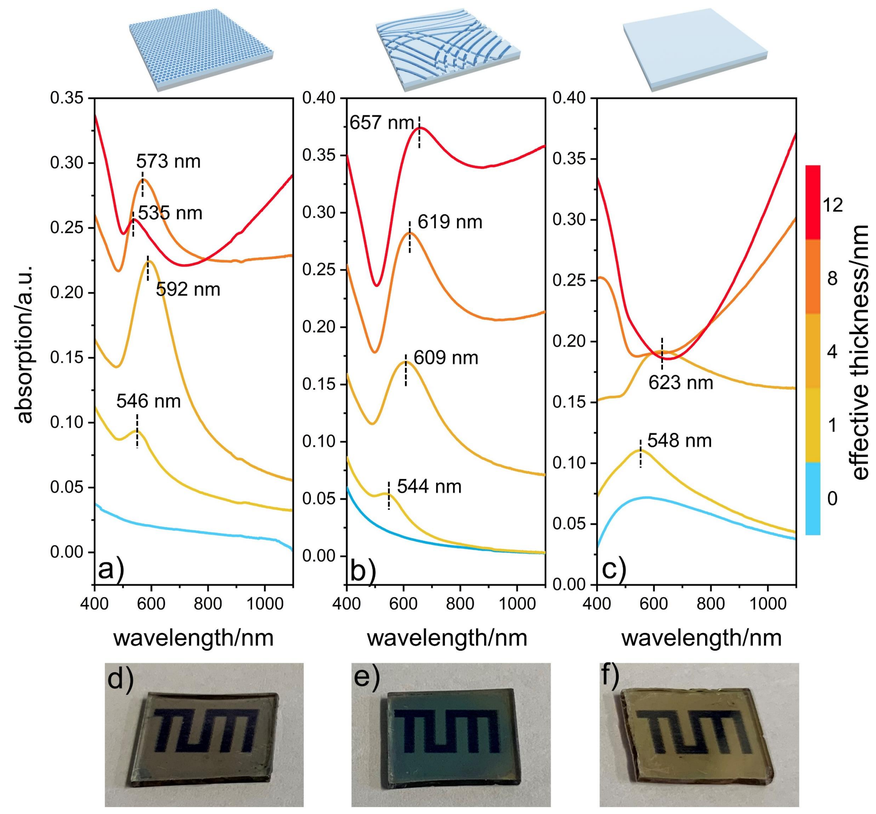
(IV) formation and growth of granular structures with higher orders

Morphology & Optical property

FESEM images



Vis.-NIR spectra & optical photographs



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