

Thin Films for Environmental Application and Energy Devices

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We aim in synthesizing various functional thin films thinner than ~ 10 nm for environmental applications and photovoltaic devices. Atomic layer deposition is used for synthesizing inorganic thin films with a precise control of the film thickness. Several examples about application of our thin films for removing volatile organic compounds (VOC) will be highlighted, which are summarized in the below. 1) TiO_2 thin films prepared by ALD at low temperature ($<100^\circ\text{C}$) show high adsorption capacity for toluene. In combination with nanostructured templates, TiO_2 thin films can be used as building-block of high-performing VOC filter. 2) TiO_2 thin films on carbon fibers and nanodiamonds annealed at high temperatures are active for photocatalytic oxidation of VOCs, i.e. photocatalytic filter can be created by atomic layer deposition. 3) NiO can catalyze oxidation of toluene to CO_2 and H_2O at $<300^\circ\text{C}$. TiO_2 thin films on NiO can reduce poisoning of NiO surfaces by reaction intermediates below 200°C . We also fabricated inverted organic solar cell based on ZnO electron collecting layers on ITO. TiO_2 thin films with a mean diameter less than 3 nm on ZnO can enhance photovoltaic performance by reducing electron-hole recombination on ZnO surfaces.

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