

VISIBLE LIGHT PHOTOCATALYSTS OF ANION DOPED TITANIA FILMS BY ION-ASSISTED VAPOR DEPOSITION

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Anion-doped titanium oxide (TiO_2) films of anatase phase were prepared by ion-assisted electron-beam evaporation of rutile powder as source material or by reactive sputtering of titanium target. Pure TiO_2 films exhibited photocatalysis only under ultraviolet (UV) radiation and their photocatalytic and hydrophilic performance is proportional to the crystallinity of anatase phase in the film. The study is aiming to shift the absorption edge of the films from UV to visible region and to promote their photo-activities under visible-light irradiation. The photocatalytic related properties under UV and visible light for the films were studied by water-contact angle measurements, methylene blue degradation and the reduction of silver ions. Various dopants including N, C, B, Al, Cr, V, and W have been attempted, but only the anions like N and C doped films exhibited significant photocatalysis under visible light. The $\text{TiO}_{2-x}\text{N}_x$ films and $\text{TiO}_{2-x}\text{C}_x$ films with the absorption edges red-shifted toward ~ 500 nm and ~ 450 nm, respectively, were formed and exhibited significant photocatalytic and hydrophilic properties under visible light. The rates of the reduction of silver ions to metals and the degradation of MB are high and the water contact-angle is near zero. Both the N and C doped films exhibit a consistent relationship among composition, structures, red-shift in visible light absorption, and the light-induced photocatalysis.

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