

Editorial

TiO₂ Photocatalytic Materials

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Received 24 April 2012; Accepted 24 April 2012

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Since the discovery of photocatalytic splitting of water on TiO₂ electrodes in 1972 by Honda and Fujishima, a great deal of effort has been devoted in recent years to the development of highly active heterogeneous photocatalysts for environmental applications including air purification, water disinfection, hazardous waste remediation, and water purification, as well as for the energy-related applications, such as, hydrogen production and solar cells. Among the various oxide and nonoxide semiconductor photocatalysts, the photocatalytic performance of titania has been most intensively studied because of its biological and chemical inertness, strong oxidizing power, cost effectiveness, and long-term stability against photocorrosion and chemical corrosion, and especially its energy band edges, which well match the redox potentials of water. However, the photocatalytic performance of TiO₂ must be further enhanced from the practical and commercial viewpoints, mainly due to the high recombination rate of photogenerated conduction band electrons and valence band holes and narrow light-response range resulting from the wide band gap. To resolve these problems, many methods have been proposed to enhance the photocatalytic activity of TiO₂, including crystal and textural modification, band gap (electronic structure) engineering, interfacial heterostructuring, noble metal loading, metal ion doping, carbon and nitrogen doping, dye sensitization, and also the usage of sacrificial reagents (electron donors or hole scavengers).

This special issue contains thirty nine papers, which mainly deal with environmental purification, hydrogen production, and dye-sensitized solar cells. Among them 30 papers are related to environmental photocatalysis, 4 papers deal with photoelectrocatalysis and photoelectrochemistry, 3

papers are devoted to photocatalytic hydrogen production, and 2 papers focus on dye-sensitized solar cells. Furthermore, this special issue contains two papers related to the photocatalytic degradation of endocrine disrupting chemicals (EDCs) present in wastewater by TiO₂ and to the preparation of film-type TiO₂ nanotube photocatalysts by liquid-phase deposition, respectively. Ten of the aforementioned papers are devoted to the doping or codoping TiO₂ photocatalysts. Eight papers deal with the composite photocatalysts. Two papers are related to the preparation, photocatalytic activity, and recovery of magnetic photocatalysts. Two papers report data on the modification of Degussa-P25 TiO₂ powders. Another two contributions describe the removal of indoor formaldehyde pollutants. Three papers are devoted to bactericidal and antibacterial activity of TiO₂. One paper deals with photocatalytic selectivity of TiO₂. Another paper discusses the plasmon photocatalytic selectivity of Au-TiO₂. Finally, two other papers are related to the low-temperature preparation of TiO₂ and photocatalytic treatment of textile wastewater, respectively. We wish to express our thanks to all the authors for submitting interesting contributions to this special issue. A brief summary of all thirty nine accepted papers is provided below.

In “*Degrading endocrine disrupting chemicals from wastewater by TiO₂ photocatalysis: a review*,” the authors discuss the heterogeneous photocatalysis, the abatement of endocrine-disrupting chemicals (EDCs), phthalates, bisphenol A and chlorophenols in particular, using TiO₂-based catalysts. Degradation mechanisms, pathways, and intermediate products of various EDCs on TiO₂ photocatalysis are described in detail. The influence of experimental conditions on the photocatalytic degradation of various EDCs on TiO₂ is

covered with a special attention. Finally, the future prospects and challenges for the photocatalytic degradation EDCs on titania are summarized and discussed.

Another contribution "A review on TiO_2 nanotube film photocatalysts prepared by liquid-phase deposition," provides a concise appraisal of studies on the formation of TiO_2 nanotube films by liquid-phase deposition based on the template-assisted growth. The formation mechanisms of anodic alumina templates and TiO_2 nanotube films are discussed. The morphology of TiO_2 is influenced by the morphology of anodic alumina. This work shows that the proper concentration of deposition solution (0.1 mol/L $(\text{NH}_4)_2\text{TiF}_6$) and proper calcination temperature (400°C) are favorable for the production of TiO_2 nanotube films.

In "Photocatalytic properties of nitrogen-doped $\text{Bi}_{12}\text{TiO}_{20}$ synthesized by urea addition sol-gel method," the undoped and nitrogen-doped $\text{Bi}_{12}\text{TiO}_{20}$ materials were synthesized by sol-gel method in the presence of urea and subjected to annealing at 600°C. The UV-Vis absorption spectra indicate that the absorbance band of N-doped samples is shifted from 420 to 500 nm due to the substitution of oxygen with nitrogen and the formation of Ti-N and N-O bonds. The optimal N-doping amount was determined. The resulting photocatalyst $\text{Bi}_{12}\text{TiO}_{20-y}\text{N}_y$ ($y = 0.03$) with N/(N+O) mole ratio of about 3% showed better performance than those strongly doped ($\text{Bi}_{12}\text{TiO}_{20-z}\text{N}_z$; $z = 0.06$), undoped ($\text{Bi}_{12}\text{TiO}_{20}$), and slightly doped ($\text{Bi}_{12}\text{TiO}_{20-x}\text{N}_x$; $x = 0.01$).

In "Hydrothermal synthesis of nitrogen-doped titanium dioxide and evaluation of its visible light photocatalytic activity," the N-doped TiO_2 was synthesized from nanotube titanate precursor via a hydrothermal route in ammonia solution. The N-doped TiO_2 catalyst showed much higher activity towards degradation of methylene blue and p-chlorophenol under visible light irradiation than Degussa P25. This is due to the enhanced absorption of N-doped TiO_2 in visible light region associated with the formation of single-electron-trapped oxygen vacancies and the inhibition of recombination of photogenerated electron-hole pair by doped nitrogen.

In "The synthetic effects of iron with sulfur and fluorine on photoabsorption and photocatalytic performance in codoped TiO_2 ," the structural and electronic properties of iron-fluorine (Fe-F-) and iron-sulfur (Fe-S-) codoped anatase TiO_2 are investigated by first-principle calculations based on density functional theory. The formation energy of codoped system is lower than that of single-element doping, which indicates the synergic effect of codoping on the stability of the structure. The codopants introduced impurity gap states resulting in the reduction of electron transition energy and thus, the visible light absorption by the samples. It is concluded that Fe-S should be a better codoping pair because it introduces extended impurity states resulting in stronger visible light absorption than those generated by Fe-F codoping compounds. This work explains the recent experiments and guides the selection of the more effective codopants in TiO_2 .

In "The photocatalytic inactivation effect of Fe-doped TiO_2 nanocomposites on leukemic HL60 cells-based photodynamic therapy," the photocatalytic inactivation of Fe-doped TiO_2

on leukemic HL60 cells was investigated using photodynamic therapy (PDT) reaction chamber based on LED light source; the viability of HL60 cells was examined by Cell Counting Kit-8 (CCK-8) assay. The growth of leukemic HL60 cells was significantly inhibited by adding TiO_2 nanoparticles, and the inactivation efficiency was effectively enhanced by the surface modification of TiO_2 nanoparticles by Fe doping.

In "Photocatalytic decomposition of amoxicillin trihydrate (AMOX) antibiotic in aqueous solutions under UV irradiation using Sn/ TiO_2 nanoparticles," the effects of Sn-doping on the crystal structure, surface area, adsorption properties, pore size distribution, and optical absorption properties of the catalysts were investigated. The resulting Sn/ TiO_2 nanoparticles exhibited high photocatalytic activity during mineralization of AMOX under UV light due to the increase of generated hydroxyl radicals, band gap energy, specific surface area, and decrease in the crystallite size. The kinetics of AMOX mineralization was explained in terms of the Langmuir-Hinshelwood model.

In "Enhanced visible light photocatalytic activity of mesoporous anatase TiO_2 codoped with nitrogen and chlorine," anatase mesoporous TiO_2 photocatalysts codoped with N and Cl (N-Cl- TiO_2) were synthesized by one-step sol-gel process in the presence of ammonium chloride. N-Cl- TiO_2 catalyst exhibited higher visible light photocatalytic activity than P25 TiO_2 and N- TiO_2 , which was attributed to the small crystallite size, intense light absorption in visible region, and narrow band gap.

In "Neodymium-doped TiO_2 with anatase and brookite two phases: mechanism for photocatalytic activity enhancement under visible light and the role of electron," the titania samples doped with neodymium (Nd) were synthesized by a sol-gel method and examined for the photocatalytic degradation of rhodamine-B under visible light. Anatase and brookite phases were detected in these samples. Additionally, Nd as Nd^{3+} may enter into the lattice of TiO_2 and the presence of Nd^{3+} substantially enhances the photocatalytic activity of TiO_2 under visible light. It was found that hydroxyl radicals produced by Nd-doped TiO_2 under visible light are reactive species for Rh-B degradation and the photogenerated electrons are mainly responsible for the formation of the reactive species.

In "Mechanistic study of visible-light-induced photodegradation of 4-chlorophenol by $\text{TiO}_{2-x}\text{N}_x$ with low nitrogen concentration," the $\text{TiO}_{2-x}\text{N}_x$ powders with low N-doping concentrations ($0.021 < x < 0.049$) were prepared by annealing commercial TiO_2 (P-25) under NH_3 flow at 550°C. Regardless of UV or visible light, the photoactivities of the samples decreased as x increased, and $\text{TiO}_{1.979}\text{N}_{0.021}$ showed the highest activity for the 4-chlorophenol (4-CP) decomposition under visible-light irradiation. The visible-light response for N-doped TiO_2 could arise from the N-induced midgap level, formed above the valence band (O 2p). Electron spin resonance (ESR) measurements and the radical scavenger methods provided the evidence that the active species (OH^\bullet and $\text{O}_2^{\bullet-}$) are responsible for the photodecomposition of 4-CP over $\text{TiO}_{2-x}\text{N}_x$ under the visible irradiation. A possible photocatalytic mechanism was discussed in detail.

In “*TiO₂:(Fe, S) thin films prepared from complex precursors by CVD, physical chemical properties, and photocatalysis*,” the TiO₂ thin films were prepared using Ti(dpm)₂(OPrⁱ)₂ and Ti(OPrⁱ)₄ (dpm = 2,2,6,6-tetramethylheptane-3,5-dione, Prⁱ = isopropyl) as the precursors. The volatile compounds Fe[(C₂H₅)₂NCS₂]₃ and [(CH₃)C]₂S₂ were used to prepare doped TiO₂ films. The synthesis was done in vacuum or in the presence of Ar and O₂. Physical, chemical, and photocatalytic properties of the (Fe, S)-doped TiO₂ films were studied. The TiO₂:(Fe, S) films prepared from the Ti(OPrⁱ)₄ precursor showed higher photocatalytic activities, very close to that of Degussa P25 powder in UV region.

In “*fabrication of Al-doped TiO₂ visible-light photocatalyst for low-concentration mercury removal*,” the high-quality Al-doped TiO₂ visible-light photocatalyst was prepared via a single-step direct combination of vaporized Ti, Al, and O₂ using a 6 kW thermal plasma system. The formed Al-doped TiO₂ nanoparticles were a mixture of anatase and rutile phases and had a size between 10 and 105 nm. The absorption spectra of these nanoparticles are shifted towards the visible light region, depending on the Al₂O₃ addition. Hg⁰ breakthrough tests revealed that the nanoparticles showed an appreciable Hg⁰ removal capability under visible-light irradiation. Nevertheless, the moisture reduced Hg removal by the nanoparticles, especially when visible-light irradiation was applied, suggesting that the competitive adsorption between H₂O and Hg species on the active sites of TiO₂ surface occurred.

In “*Effect of Ag-Cu bimetallic components in a TiO₂ framework for high hydrogen production on methanol/water photo-splitting*,” the TiO₂ photocatalysts doped with Ag, Cu, and Cu-Ag were prepared for the production of H₂ from methanol/water photodecomposition. As compared to monometal-incorporated TiO₂, the H₂ production was markedly enhanced in bimetal-incorporated photocatalyst.

In “*Photoelectrocatalytic degradation of sodium oxalate by TiO₂/Ti thin film electrode*,” the photocatalytically active TiO₂ thin films were deposited on the titanium substrate plate by chemical vapor deposition (CVD) method, and the photoelectrocatalytic degradation of sodium oxalate was investigated. The additional applied potential in photocatalytic reaction could prohibit recombination of electron/hole pairs, but the photoelectrocatalytic effect was decreased when the applied electric potential was over 0.25 V.

In “*Anodization parameters influencing the growth of titania nanotubes and their photoelectrochemical response*,” the TiO₂ nanotubes (TNTs) were fabricated by electrochemical oxidation of Ti foil in a standard two-electrode cell-containing NH₄F. The tube length decreased with bath temperature, which can be attributed to the faster chemical dissolution rate at high temperatures. However, nanotubes growth rate was enhanced by ~260% with the addition of EDTA as the complexing agent. Meanwhile, the nanotubes diameter was found to be proportionally dependent on bath temperature but independent of the voltage ramp and addition of EDTA. The photoelectrochemical response under illumination was enhanced by using the calcined TNT.

In “*Effect of N,C-ITO on composite N,C-TiO₂/N,C-ITO/ITO electrode used for photoelectrochemical degradation*

of aqueous pollutant with simultaneous hydrogen production,” the composite Ti/TO electrode was simultaneously used for hydrogen production and degradation of organic pollutants. The N,C-TiO₂ layer in this electrode enhanced not only the photocurrent response at entire applied potentials but also the flat band potential; a shift of about 0.1 V towards cathode was observed, which is beneficial for the PEC process.

In “*Investigation on the photoelectrocatalytic activity of well-aligned TiO₂ nanotube arrays*,” the well-aligned TiO₂ nanotube arrays were fabricated by anodizing Ti foil in viscous F⁻ containing organic electrolytes, and their photocatalytic activity was evaluated in the photocatalytic (PC) and photoelectrocatalytic (PEC) degradation of methylene blue (MB) dye in different supporting solutions. The excellent performance of ca. 97% for color removal was reached after 90 min in the PEC process compared to that of PC process which indicates that a certain external potential bias favors the promotion of the electrode reaction rate on the TiO₂ nanotube array when it is under illumination. In addition, it was found that the PEC degradation of MB conducted in supporting solutions was accelerated at low pH and in the presence of Cl⁻.

In “*Photocatalytic oxidation of triiodide in UVA-exposed dye-sensitized solar cells*,” the UVA irradiation of glass mounted dye-sensitized solar cells without UV filtration caused a failure within 400 hours of light exposure. The failure mode was shown to relate to the consumption of I₃⁻, which was directly related to TiO₂ photocatalysis. The device failure was more rapid for the cells under electrical load indicating that the degradation of the electrolyte is related to photogenerated hole production by excitation of TiO₂. Once depleted by UV exposure, the I₃⁻ was regenerated by simple application of a reverse bias, which can restore severely the UV-degraded devices to near original working conditions.

In “*Effects of homogenization scheme of TiO₂ screen-printing paste for dye-sensitized solar cells*,” the TiO₂ screen-printing paste was prepared by two methods to disperse the nanocrystalline TiO₂ powder: a “ball-milling route” and a “mortar-grinding route.” The TiO₂ ball-milling (TiO₂-BM) route gave monodisperse TiO₂ nanoparticles, resulting in high photocurrent density (14.2 mA cm⁻²) and high photoconversion efficiency (8.27%). On the other hand, the TiO₂ mortar-grinding (TiO₂-MG) route gave large aggregates of TiO₂ nanoparticles, resulting in low photocurrent density (11.5 mA cm⁻²) and low photoconversion efficiency (6.43%).

In “*Enhancing photocatalytic performance through tuning the interfacial process between TiO₂-assembled and Pt-loaded microspheres*,” the Pt-TiO₂ microspheres were prepared in a solution with subsequent Pt loading through a photoreduction. The Pt loading led to an efficient separation of photogenerated electron-hole pairs. Meanwhile, electrons stored in the “microcapacitor” of TiO₂ microspheres contributed to the enhancement of photocatalytic activity under UV light irradiation.

In “*Facile synthesis and photocatalytic property of titania/carbon composite hollow microspheres with bimodal mesoporous shells*,” the titania/carbon composite hollow microspheres with bimodal mesoporous shells were fabricated

by one-pot procedure involving acidic $(\text{NH}_4)_2\text{TiF}_6$ aqueous solution in the presence of glucose at 180°C for 24 h and then calcined at 450°C for 2–4 h. All TiO_2/C composite hollow spheres generally exhibited bimodal mesopore size distribution with peaks in the range of 2.3–4.5 nm and 5.7–12.7 nm. The TiO_2 -2 sample showed the highest daylight-induced photocatalytic activity and greatly exceeded that of Degussa P25.

In “*Performance of Ag-TiO₂ photocatalysts towards the photocatalytic disinfection of water under interior-lighting and solar-simulated light irradiations*,” the characterization and photoactivity of Ag-TiO₂ materials was studied using different amounts of silver during the hydrothermal synthesis. The resulting photocatalysts were tested towards photocatalytic disinfection of water using a solar light simulator and an interior-light irradiation setup. The obtained data indicate an increase in the photooxidative effect of TiO₂, while dark processes show that the partial inactivation is due to the Ag-TiO₂ surface bactericidal effect and possible leached Ag⁺.

In “*Preparation and photocatalytic property of TiO₂/diatomite-based porous ceramics composite materials*,” the nano-TiO₂/diatomite-based porous ceramics composite materials were prepared by hydrolysis deposition method using titanium tetrachloride as the precursor of TiO₂ and diatomite as the porous support. After calcination at 550°C , the thin TiO₂ anatase film was formed on the diatomite with the average grain size of TiO₂ of about 10 nm. The degradation ratio for 5 mg/L malachite green solution reached 86.2% after irradiation for 6 h under ultraviolet.

In “*Anatase TiO₂ nanospindle/activated carbon (AC) composite photocatalysts with enhanced activity in removal of organic contaminant*,” a novel TiO₂/AC composite photocatalyst was prepared by coating of anatase TiO₂ nanospindles onto the surface of AC particles, which showed better photocatalytic activity than pure TiO₂ due to the synergistic effect between supporting materials and TiO₂ nanospindles. Most importantly, this composite photocatalysts effectively reduced the leaching of TiO₂ from the surface of AC.

In “*Preparation and photocatalytic activity of TiO₂-deposited fabrics*,” the nanoscale TiO₂ photocatalytic films were formed on the surface of polyester nonwovens by using direct current reactive magnetron sputtering. The test results proved that the grain sizes of the sputtered clusters increased and the coating layer became more compact with increasing film thickness, but the composition of films did not change significantly. The photocatalytic activity of TiO₂-coated fabrics mostly depended on the film thickness.

In “*Synthesis of Fe₃O₄/C/TiO₂ magnetic photocatalyst via vapor phase hydrolysis*,” a core/multishell-structured Fe₃O₄/C/TiO₂ magnetic photocatalyst was prepared via vapor phase hydrolysis process. The size and crystallinity of anatase TiO₂ crystallite in the shell could be tuned by temperature and duration of the process. The photocatalytic activity of Fe₃O₄/C/TiO₂ was higher than that of the commercial anatase TiO₂ in photocatalytic degradation of methylene blue (MB), and its recycling property was significantly improved. The intermediate carbon layer can effectively eliminate the electron interaction or photodissolution of Fe₃O₄ occurring at the point of contact.

In “*Preparation, photocatalytic activity, and recovery of magnetic photocatalyst for decomposition of benzoic Acid*,” the optimal experimental parameters of TiO₂ preparation were pH 3, weight ratio of TiO₂/SiO₂(Fe₃O₄) at 1 and calcination temperature of TiO₂/SiO₂/Fe₃O₄ at 350°C . Furthermore, the paramagnetic behaviors of the prepared TiO₂/SiO₂/Fe₃O₄ gave rise to the magnetic photocatalyst, which could be separated more easily through the application of a magnetic field.

In “*Enhanced photocatalytic activity of TiO₂ powders (P25) via calcination treatment*,” the authors showed that calcination influenced the microstructures and photocatalytic activity of the P25 TiO₂ powders. An optimal calcination temperature (500°C) was determined, and the photocatalytic activity of TiO₂ powders calcined at 500°C was nearly twice higher than that of the uncalcined P25 TiO₂.

In “*Photocatalytic degradation of NO_x using Ni-containing TiO₂*,” a nickel-modified titania photocatalyst was prepared by photodeposition method using Degussa-P25 TiO₂ particle and nickel chloride as raw materials. Ni did not enter into the TiO₂ crystal lattice and was uniformly dispersed onto the TiO₂ surface. The modified titanium dioxide with 0.1 mol% of nickel exhibited twice higher the NO_x-removal activity in comparison to the bare TiO₂ under ultraviolet illumination. The nickel content in this photodeposition process plays an important role in controlling affinity towards NO_x molecules, recombination rate of electron-hole pair, and the content of active sites on the TiO₂ surface and therefore, affects the optical and photocatalytic properties.

In “*Effects of calcination temperatures on photocatalytic activity of ordered titanate nanoribbon (TNR)/SnO₂ films fabricated during an EPD process*,” the highest photocatalytic activity was obtained for the calcined TNR/SnO₂ film at 600°C due to the formation of well-crystallized anatase phase, the unique morphology, and the fast charge carrier separation and transfer at the interface of TiO₂ and SnO₂.

In “*Synergistic effect of nanophotocatalysis and nonthermal plasma on the removal of indoor HCHO*,” the effect of combination of photocatalytic oxidation (PCO) with non-thermal plasma technology (NTP) on the removal of indoor HCHO was investigated. The effects of plasma discharge configuration, the applied voltage, the flow velocity, and the humidity on the HCHO removal were studied. The HCHO removal was shown to be more effective in the line-to-plate electrode discharge reactor; the HCHO reaction rate was enhanced and the amount of air that needs to be cleaned was enlarged. The synergistic effect was observed for the indoor air purification by combining PCO with NTP.

In “*Degradation of gaseous formaldehyde by visible light-responsive titania photocatalyst filter*,” a method is proposed by using electrophoretic deposition (EPD) to fabricate the titania (TiO₂) photocatalyst filter, which after modification with lithium nitrate (LiNO₃) became responsive to visible light and effectively degraded gaseous formaldehyde. The best total average degradation performance of this photocatalyst filter was about 9.2% and 16.3% higher than that of the original photocatalyst filter (P-25, Degussa) at the UVA and visible irradiation, respectively, at 26°C .

In "Preparation of antibacterial color-coated steel sheets," a simple way to manufacture antibacterial color-coated sheet using Ag-loaded TiO₂ is developed. The optimal technical parameters are 2% for silver-loaded titanium dioxide, which is dispersed well as color-coated sheets, reaching the antibacterial efficiency of 99.99%. The efficiency of methyl orange degradation reached 88% in 4 h.

In "Highly selective deethylation of rhodamine B on TiO₂ prepared in supercritical fluids," a pure phase anatase TiO₂ nanoparticles with sizes of 5–8 nm and different crystallinity were synthesized in supercritical isopropanol/water using a continuous flow reactor. Their photodegradation of rhodamine B (RhB) was evaluated under visible light irradiation. The as-prepared TiO₂ nanoparticles showed much higher photodegradation efficiencies than commercial Degussa P25 TiO₂. Moreover, the photodegradation of RhB on the as-prepared TiO₂ follows a different process than that on P25 TiO₂, quicker N-deethylation and slower cleavage of conjugated chromophore structure.

In "Enhancement of visible-light photocatalytic activity of mesoporous Au-TiO₂ nanocomposites by surface plasmon resonance," the Au-TiO₂ nanocomposites were prepared by a simple spray hydrolytic method with photoreduction at 90°C. The light absorption, the formation rates of hydroxyl radicals, and photocatalytic decolorization of RhB aqueous solution were significantly enhanced by the embedded Au nanoparticles in the Au-TiO₂ nanocomposites due to the surface plasmon resonance. The composite R_{Au}-0.015 sample exhibited the best visible-light photocatalytic activity for decolorization of RhB aqueous solution due to the synergistic effects of the absorption shift into visible and improved efficiency of interfacial charge transfer process.

In "Ta/TiO₂- and Nb/TiO₂-mixed oxides as efficient solar photocatalysts: preparation, characterization, and photocatalytic activity," Ta/TiO₂- and Nb/TiO₂-mixed oxide photocatalysts were prepared by simple impregnation method using different TiO₂ : Nb mass ratios, followed by calcination at 500°C. Nb/TiO₂- and Ta/TiO₂-mixed oxides showed higher activity than the untreated TiO₂ under natural solar light. The maximum activity was observed for Nb/TiO₂ sample (at mass ratio of 1 : 0.1), characterized by the smallest crystalline size (17.79 nm). As compared to the untreated TiO₂, the solar decolorization and mineralization rates improved by about 140% and 237%, respectively, and the band gap was reduced to 2.80 eV.

In "Removal of a cationic dye by adsorption/photodegradation using electrospun PAN/O-MMT composite nanofibrous membranes coated with TiO₂," the polyacrylonitrile (PAN)/organic-modified montmorillonite (O-MMT) nanofibrous composite membranes were firstly prepared by electrospinning and then coated with titanium dioxide (TiO₂) using spin coating technique. With the increase of O-MMT amount, the diameters of the nanofibers decreased, and the adsorption rate of MB was evidently improved. Besides, with the increase of TiO₂ film thickness, the photocatalytic properties were enhanced while the adsorption process was slowed down.

In "Low-temperature reverse microemulsion synthesis, characterization, and photocatalytic performance of nanocrystalline

titanium dioxide," the nanosized TiO₂ nanoparticles were synthesized in n-hexanol/CTAB/water reverse microemulsions. Among all the as-synthesized photocatalysts by aging method, the nanoparticles aged at 65°C for 90 h showed the highest photocatalytic activity, which was higher than that of commercial P25.

In "TiO₂-based photocatalytic treatment of raw and constructed-wetland pretreated textile wastewater," a combination of photocatalytic and biological degradation of wastewaters generated in textile production (simulation of real textile effluent) is presented.

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