# Document details



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## Enhancing the performance of self - powered ultraviolet photosensor using rapid aqueous chemical - grown aluminum - doped titanium oxide nanorod arrays as electron transport layer (Article)

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## Abstract

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Aluminum (Al)- doped titanium dioxide nanorod arrays (ATNs) were grown on fluorine- doped tin oxide - coated glass at different Al atomic concentrations ranging from 1 at.% to 5 at.% in a Schott bottle through single-step aqueous chemical growth for self - powered photoelectrochemical cell-type ultraviolet (UV) photosensor applications. X-ray diffraction patterns showed that the grown ATNs exhibited a crystalline rutile structure. The ATNs showed smaller crystallite size and average nanorod diameter and length compared with the undoped sample. The photocurrent measured from the fabricated UV photosensors improved to some extent with increasing Al-dopant concentration. Samples with 2 at.% Al showed the maximum photocurrent of 108.87 μA/cm$^2$ at 0 V bias under UV irradiation (365 nm, 750 μW/cm$^2$). The results show that high- performance UV photosensors can be fabricated and enhanced using ATNs easily prepared in a glass container. © 2018 Elsevier B.V.

## Reaxys Database Information

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## Author keywords

Aluminum - doped titanium dioxide | Nanorods | Photoelectrochemical cell | Structural properties | Ultraviolet photosensor

## Indexed keywords

Engineering controlled terms: Aluminum alloys | Aluminum oxide | Bottles | Crystallite size | Doping (additives) | Electrochemical cells | Electrochemistry | Electron transport properties | Glass | Irradiation | Nanocomposites | Nanorods | Optical sensors | Oxide minerals | Photoelectrochemical cells | Photosensitivity | Structural properties | Tin dioxide | Tin oxides | Titanium dioxide | Titanium oxides | X ray diffraction

Compendex keywords: Aqueous chemical growth | Atomic concentration | Electron transport layers | Fluorine doped tin oxide | Glass containers | Oxide nanorod arrays | Photosensor | Rutile structure

Engineering main heading: Aluminum coatings

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## References (109)

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View all 109 references

1 Ballester, J., García-Armingol, T.
Diagnostic techniques for the monitoring and control of practical flames
(2010) *Progress in Energy and Combustion Science*, 36 (4), pp. 375-411. Cited 144 times.
doi: 10.1016/j.pecs.2009.11.005
View at Publisher

2 Liu, K.W., Ma, J.G., Zhang, J.Y., Lu, Y.M., Jiang, D.Y., Li, B.H., Zhao, D.X., (...), Shen, D.Z.
Ultraviolet photoconductive detector with high visible rejection and fast photoresponse based on ZnO thin film
(2007) *Solid-State Electronics*, 51 (5), pp. 757-761. Cited 124 times.
doi: 10.1016/j.sse.2007.03.002
View at Publisher

3 Ngu, Y., Peckerar, M.C., Sander, D., Eddy Jr., C.R., Mastro, M.A., Hite, J.K., Holm, R.T., (...), Tuchman, A.
Array of two UV-wavelength detector types
(2010) *IEEE Transactions on Electron Devices*, 57 (6), art. no. 5453058, pp. 1224-1229. Cited 10 times.
doi: 10.1109/TED.2010.2045706
View at Publisher

4 Wang, H., Sun, Q., Yao, Y., Li, Y., Wang, J., Chen, L.
A micro sensor based on $TiO_2$ nanorod arrays for the detection of oxygen at room temperature
(2016) *Ceramics International*, 42 (7), pp. 8565-8571. Cited 12 times.
doi: 10.1016/j.ceramint.2016.02.084
View at Publisher

conductivities in aluminum-doped TiO2
Xu, L. , Garrett, M.P. , Hu, B.
*(2012) Journal of Physical Chemistry C*

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5 Selman, A.M., Hassan, Z., Husham, M., Ahmed, N.M.
A high-sensitivity, fast-response, rapid-recovery p-n heterojunction photodiode based on rutile $TiO_2$ nanorod array on p-Si(1 1 1)

(2014) *Applied Surface Science*, 305, pp. 445-452. Cited 31 times.
http://www.elsevier.com/wps/find/journaldescription.cws_home/505669/description#description
doi: 10.1016/j.apsusc.2014.03.109

View at Publisher

6 Yanru, X., Lin, W., Qinghao, L., Yanxue, C., Shishen, Y., Jun, J., Guolei, L., (...), Liangmo, M.
High-performance self-powered UV photodetectors based on $TiO_2$ nano-branched arrays
(2014) *Nanotechnology*, 25.

7 Zu, X., Wang, H., Yi, G., Zhang, Z., Jiang, X., Gong, J., Luo, H.
Self-powered UV photodetector based on heterostructured $TiO_2$ nanowire arrays and polyaniline nanoflower arrays

(2015) *Synthetic Metals*, 200, pp. 58-65. Cited 12 times.
http://www.journals.elsevier.com/synthetic-metals/
doi: 10.1016/j.synthmet.2014.12.030

View at Publisher

8 Yang, H.-Y., Cheng, X.-L., Zhang, X.-F., Zheng, Z.-K., Tang, X.-F., Xu, Y.-M., Gao, S., (...), Huo, L.-H.
A novel sensor for fast detection of triethylamine based on rutile $TiO_2$ nanorod arrays

(2014) *Sensors and Actuators, B: Chemical*, 205, pp. 322-328. Cited 39 times.
doi: 10.1016/j.snb.2014.08.092

View at Publisher

9 Ohno, T., Higo, T., Murakami, N., Saito, H., Zhang, Q., Yang, Y., Tsubota, T.
Photocatalytic reduction of $CO_2$ over exposed-crystal-face-controlled $TiO_2$ nanorod having a brookite phase with co-catalyst loading

(2014) *Applied Catalysis B: Environmental*, 152-153 (1), pp. 309-316. Cited 45 times.
doi: 10.1016/j.apcatb.2014.01.048

View at Publisher

10 Petronella, F., Diomede, S., Fanizza, E., Mascolo, G., Sibillano, T., Agostiano, A., Curri, M.L., (...), Comparelli, R.
Photodegradation of nalidixic acid assisted by $TiO_2$ nanorods/Ag nanoparticles based catalyst

(2013) *Chemosphere*, 91 (7), pp. 941-947. Cited 21 times.
doi: 10.1016/j.chemosphere.2013.01.107

View at Publisher

11 Cao, C., Hu, C., Wang, X., Wang, S., Tian, Y., Zhang, H.
UV sensor based on $TiO_2$ nanorod arrays on FTO thin film

(2011) *Sensors and Actuators, B: Chemical*, 156 (1), pp. 114-119. Cited 114 times.
doi: 10.1016/j.snb.2011.03.080

View at Publisher

12 Alev, O., Şennik, E., Kilinç, N., Öztürk, Z.Z.
Gas sensor application of hydrothermally growth $TiO_2$ nanorods (Open Access)

(2015) *Procedia Engineering*, 120, pp. 1162-1165. Cited 9 times.
http://www.sciencedirect.com/science/journal/18777058
doi: 10.1016/j.proeng.2015.08.747

View at Publisher

13 Lu, J., Liu, Z., Zhu, C., Zhang, M., Wan, M.
Effect of the morphology of the TiO2 nanorods on the photovoltaic properties of the dye-sensitized solar cells

(2015) *Materials Letters*, 159, art. no. 19032, pp. 61-63. Cited 11 times.
http://www.journals.elsevier.com/materials-letters/
doi: 10.1016/j.matlet.2015.05.138

View at Publisher

14 Zhang, M., Li, D., Zhou, J., Chen, W., Ruan, S.
Ultraviolet detector based on $TiO_2$nanowire array-polymer hybrids with low dark current

(2014) *Journal of Alloys and Compounds*, 618, pp. 233-235. Cited 15 times.
doi: 10.1016/j.jallcom.2014.07.040

View at Publisher

15 Selman, A.M.
Studies on the influence of growth time on the rutile TiO2 nanostructures prepared on Si substrates with fabricated high-sensitivity and fast-response p-n heterojunction photodiode
(2016) *Am. J. Nano Res. Appl.*, 4, pp. 23-32.

16 Selman, A.M., Hassan, Z.
Structural and photoluminescence studies of rutile TiO2 Nanorods prepared by CBD method on Si substrates
(2015) *Am. J. Mater. Sci.*, 5, pp. 16-20. Cited 2 times.

17 Hoffmann, M.R., Martin, S.T., Choi, W., Bahnemann, D.W.
Environmental Applications of Semiconductor Photocatalysis

(1995) *Chemical Reviews*, 95 (1), pp. 69-96. Cited 14242 times.
doi: 10.1021/cr00033a004

View at Publisher

18 Körner, W., Elsässer, C.
Density functional theory study of dopants in polycrystalline $TiO_2$

(2011) *Physical Review B - Condensed Matter and Materials Physics*, 83 (20), art. no. 205315. Cited 23 times.
http://oai.aps.org/filefetch?identifier=10.1103/PhysRevB.83.205315&component=fulltext&description=markup&format=xml
doi: 10.1103/PhysRevB.83.205315

View at Publisher

19 Tsuyumoto, I., Hosono, T., Murata, M.
Thermoelectric power in nonstoichiometric orthorhombic titanium oxides

(2006) *Journal of the American Ceramic Society*, 89 (7), pp. 2301-2303. Cited 27 times.
doi: 10.1111/j.1551-2916.2006.00979.x

View at Publisher

20 Tang, J., Wang, W., Zhao, G.-L., Li, Q.
Colossal positive Seebeck coefficient and low thermal conductivity in reduced $TiO_2$

(2009) *Journal of Physics Condensed Matter*, 21 (20), art. no. 205703. Cited 26 times.
doi: 10.1088/0953-8984/21/20/205703

View at Publisher

21 Huy, H.A., Aradi, B., Frauenheim, T., Deák, P.
Calculation of carrier-concentration-dependent effective mass in Nb-doped anatase crystals of $TiO_2$

(2011) *Physical Review B - Condensed Matter and Materials Physics*, 83 (15), art. no. 155201. Cited 26 times.
http://oai.aps.org/filefetch?identifier=10.1103/PhysRevB.83.155201&component=fulltext&description=markup&format=xml
doi: 10.1103/PhysRevB.83.155201

View at Publisher

22 Ha, T.-J., Park, H.-H., Jung, S.-Y., Yoon, S.-J., Kim, J.-S., Jang, H.W.
Effect of porosity on the Seebeck coefficient of mesoporous $TiO_2$ thin films

(2010) *Thin Solid Films*, 518 (24), pp. 7196-7198. Cited 12 times.
doi: 10.1016/j.tsf.2010.04.074

View at Publisher

23 Dy, E., Hui, R., Zhang, J., Liu, Z.-S., Shi, Z.
Electronic conductivity and stability of doped titania ($Ti_{1-x}M_xO_2$, M = Nb, Ru, and Ta)- A density functional Theory-Based comparison

(2010) *Journal of Physical Chemistry C*, 114 (31), pp. 13162-13167. Cited 20 times.
doi: 10.1021/jp100826g

View at Publisher

24 Nowotny, J., Bak, T., Burg, T.
Electrical properties of polycrystalline $TiO_2$. Thermoelectric power

(2007) *Ionics*, 13 (3), pp. 155-162. Cited 13 times.
doi: 10.1007/s11581-007-0085-z

View at Publisher

25 Jung, S.-Y., Ha, T.-J., Seo, W.-S., Lim, Y.S., Shin, S., Cho, H.H., Park, H.-H.
Thermoelectric properties of Nb-doped ordered mesoporous $TiO_2$

(2011) *Journal of Electronic Materials*, 40 (5), pp. 652-656. Cited 11 times.
doi: 10.1007/s11664-010-1498-4

View at Publisher

26 Palomares, E., Clifford, J.N., Haque, S.A., Lutz, T., Durrant, J.R.
Control of charge recombination dynamics in dye sensitized solar cells by the use of conformally deposited metal oxide blocking layers

(2003) *Journal of the American Chemical Society*, 125 (2), pp. 475-482. Cited 894 times.
doi: 10.1021/ja027945w

View at Publisher

27 Durrant, J.R., Haque, S.A., Palomares, E.
Towards optimisation of electron transfer processes in dye sensitised solar cells

(2004) *Coordination Chemistry Reviews*, 248 (13-14), pp. 1247-1257. Cited 223 times.
doi: 10.1016/j.ccr.2004.03.014

View at Publisher

28 Snaith, H.J., Ducati, C.
$SnO_2$-Based dye-sensitized hybrid solar cells exhibiting near unity absorbed photon-to-electron conversion efficiency

(2010) *Nano Letters*, 10 (4), pp. 1259-1265. Cited 292 times.
doi: 10.1021/nl903809r

View at Publisher

29 Chen, S.G., Chappel, S., Diamant, Y., Zaban, A.

Preparation of $Nb_2O_5$ coated $TiO_2$ nanoporous electrodes and their application in dye-sensitized solar cells

(2001) *Chemistry of Materials*, 13 (12), pp. 4629-4634. Cited 294 times.
doi: 10.1021/cm010343b

View at Publisher

30 Tennakone, K., Bandara, J., Bandaranayake, P.K.M., Kumara, G.R.A., Konno, A.

Enhanced efficiency of a dye-sensitized solar cell made from MgO-coated nanocrystalline $SnO_2$

(2001) *Japanese Journal of Applied Physics, Part 2: Letters*, 40 (7 B), pp. L732-L734. Cited 153 times.

31 Wang, M., Plogmaker, S., Humphry-Baker, R., Pechy, P., Rensmo, H., Zakeeruddin, S.M., Grätzel, M.

Molecular-scale interface engineering of nanocrystalline titania by co-adsorbents for solar energy conversion

(2012) *ChemSusChem*, 5 (1), pp. 181-187. Cited 24 times.
http://www.interscience.wiley.com/jpages/1864-5631
doi: 10.1002/cssc.201100549

View at Publisher

32 Lou, Y., Yuan, S., Zhao, Y., Hu, P., Wang, Z., Zhang, M., Shi, L., (...), Li, D.

Molecular-scale interface engineering of metal nanoparticles for plasmon-enhanced dye sensitized solar cells

(2013) *Dalton Transactions*, 42 (15), pp. 5330-5337. Cited 19 times.
doi: 10.1039/c3dt32741h

View at Publisher

33 O'Regan, B.C., Durrant, J.R., Sommeling, P.M., Bakker, N.J.

Influence of the $TiCl_4$ treatment on nanocrystalline $TiO_2$ films in dye-sensitized solar cells. 2. Charge density, band edge shifts, and quantification of recombination losses at short circuit

(2007) *Journal of Physical Chemistry C*, 111 (37), pp. 14001-14010. Cited 396 times.
doi: 10.1021/jp073056p

View at Publisher

34 Murcia López, S., Hidalgo, M.C., Navío, J.A., Colón, G.

Novel $Bi_2WO_6$-$TiO_2$ heterostructures for Rhodamine B degradation under sunlike irradiation

(2011) *Journal of Hazardous Materials*, 185 (2-3), pp. 1425-1434. Cited 59 times.
doi: 10.1016/j.jhazmat.2010.10.065

View at Publisher

35 Zhou, P., Wu, J., Yu, W., Zhao, G., Fang, G., Cao, S.

Vectorial doping-promoting charge transfer in anatase $TiO_2${0 0 1}surface

(2014) *Applied Surface Science*, 319 (1), pp. 167-172. Cited 42 times.
http://www.journals.elsevier.com/applied-surface-science/
doi: 10.1016/j.apsusc.2014.05.045

View at Publisher

36 Feng, H., Zhang, M.-H., Yu, L.E.

Hydrothermal synthesis and photocatalytic performance of metal-ions doped $TiO_2$

(2012) *Applied Catalysis A: General*, 413-414, pp. 238-244. Cited 48 times.
doi: 10.1016/j.apcata.2011.11.014

View at Publisher

37 Han, C., Andersen, J., Likodimos, V., Falaras, P., Linkugel, J., Dionysiou, D.D.

The effect of solvent in the sol-gel synthesis of visible light-activated, sulfur-doped TiO2 nanostructured porous films for water treatment

(2014) *Catalysis Today*, 224, pp. 132-139. Cited 31 times.
doi: 10.1016/j.cattod.2013.11.052

View at Publisher

38 Yu, J., Xiong, J., Cheng, B., Liu, S.

Fabrication and characterization of Ag-$TiO_2$ multiphase nanocomposite thin films with enhanced photocatalytic activity

(2005) *Applied Catalysis B: Environmental*, 60 (3-4), pp. 211-221. Cited 521 times.
doi: 10.1016/j.apcatb.2005.03.009

View at Publisher

39 Das, K., Sharma, S.N., Kumar, M., De, S.K.

Morphology dependent luminescence properties of Co doped TiO2 nanostructures

(2009) *Journal of Physical Chemistry C*, 113 (33), pp. 14783-14792. Cited 79 times.
http://pubs.acs.org/doi/pdfplus/10.1021/jp9048956
doi: 10.1021/jp9048956

View at Publisher

40 O'Rourke, C., Bowler, D.R.

Intrinsic oxygen vacancy and extrinsic aluminum dopant interplay: A route to the restoration of defective TiO2

(2014) *Journal of Physical Chemistry C*, 118 (14), pp. 7261-7271. Cited 11 times.
doi: 10.1021/jp407736f

View at Publisher

41 Manoharan, K., Venkatachalam, P.

Photoelectrochemical performance of dye sensitized solar cells based on aluminum-doped titanium dioxide structures

(2015) *Materials Science in Semiconductor Processing*, 30, pp. 208-217. Cited 8 times.
doi: 10.1016/j.mssp.2014.08.012

View at Publisher

42 Adamczyk, A., Długoń, E.

The FTIR studies of gels and thin films of Al 2O 3-TiO 2 and Al 2O 3-TiO 2-SiO 2 systems

(2012) *Spectrochimica Acta - Part A: Molecular and Biomolecular Spectroscopy*, 89, pp. 11-17. Cited 47 times.
doi: 10.1016/j.saa.2011.12.018

View at Publisher

43 Lin, S.-S., Wu, D.-K.

Effect of RF deposition power on the properties of Al-doped $TiO_2$ thin films

(2010) *Surface and Coatings Technology*, 204 (14), pp. 2202-2207. Cited 9 times.
doi: 10.1016/j.surfcoat.2009.12.007

View at Publisher

44 Reidy, D.J., Holmes, J.D., Morris, M.A.

The critical size mechanism for the anatase to rutile transformation in $TiO_2$ and doped-$TiO_2$

(2006) *Journal of the European Ceramic Society*, 26 (9), pp. 1527-1534. Cited 123 times.
doi: 10.1016/j.jeurceramsoc.2005.03.246

View at Publisher

45 Zhu, K., Neale, N.R., Miedaner, A., Frank, A.J.
Enhanced charge-collection efficiencies and light scattering in dye-sensitized solar cells using oriented $TiO_2$ nanotubes arrays

(2007) *Nano Letters*, 7 (1), pp. 69-74. Cited 1707 times.
doi: 10.1021/nl062000o

View at Publisher

46 Xu, L., Garrett, M.P., Hu, B.
Doping effects on internally coupled seebeck coefficient, electrical, and thermal conductivities in aluminum-doped $TiO_2$

(2012) *Journal of Physical Chemistry C*, 116 (24), pp. 13020-13025. Cited 21 times.
doi: 10.1021/jp302652c

View at Publisher

47 Lee, J.E., Oh, S.-M., Park, D.-W.
Synthesis of nano-sized Al doped $TiO_2$ powders using thermal plasma

(2004) *Thin Solid Films*, 457 (1), pp. 230-234. Cited 72 times.
doi: 10.1016/j.tsf.2003.12.027

View at Publisher

48 Song, Y.-S., Kim, B.-Y., Cho, N.-I., Lee, D.Y.
Effect of Al doping on optical band gap energy of Al-$TiO_2$ thin films

(2015) *Journal of Nanoscience and Nanotechnology*, 15 (7), pp. 5228-5231. Cited 5 times.
http://docserver.ingentaconnect.com/deliver/connect/asp/15334880/v15n7/s77.pdf?expires=1421036434&id=80426144&titleid=4286&accname=Elsevier+BV&checksum=48C272795AE0AA7D293C9A3306ABE085
doi: 10.1166/jnn.2015.10380

View at Publisher

49 Taylor, M.L., Morris, G.E., Smart, R.St.C.
Influence of aluminum doping on titania pigment structural and dispersion properties

(2003) *Journal of Colloid and Interface Science*, 262 (1), pp. 81-88. Cited 45 times.
http://www.elsevier.com/inca/publications/store/6/2/2/8/6/1/index.htt
doi: 10.1016/S0021-9797(03)00212-1

View at Publisher

50 Kim, S.K., Choi, G.-J., Lee, S.Y., Seo, M., Lee, S.W., Han, J.H., Ahn, H.-S., (...), Hwang, C.S.
Al-doped TiO2 films with ultralow leakage currents for next generation DRAM capacitors

(2008) *Advanced Materials*, 20 (8), pp. 1429-1435. Cited 205 times.
http://www3.interscience.wiley.com/cgi-bin/fulltext/117943838/PDFSTART
doi: 10.1002/adma.200701085

View at Publisher

51 Rajabi, M., Shogh, S., Iraji Zad, A.
Defect study of $TiO_2$ nanorods grown by a hydrothermal method through photoluminescence spectroscopy

(2015) *Journal of Luminescence*, 157, pp. 235-242. Cited 18 times.
doi: 10.1016/j.jlumin.2014.08.035

View at Publisher

52 Feng, X., Shankar, K., Varghese, O.K., Paulose, M., Latempa, T.J., Grimes, C.A.
Vertically aligned single crystal TiO $^{2}$ nanowire arrays grown directly on transparent conducting oxide coated glass: Synthesis details and applications

(2008) *Nano Letters*, 8 (11), pp. 3781-3786. Cited 925 times.
doi: 10.1021/nl802096a

View at Publisher

53 Aguilar, T., Navas, J., Alcántara, R., Fernández-Lorenzo, C., Gallardo, J.J., Blanco, G., Martín-Calleja, J.
A route for the synthesis of Cu-doped $TiO_2$ nanoparticles with a very low band gap

(2013) *Chemical Physics Letters*, 571, pp. 49-53. Cited 32 times.
doi: 10.1016/j.cplett.2013.04.007

View at Publisher

54 Tripathi, A.K., Mathpal, M.C., Kumar, P., Singh, M.K., Soler, M.A.G., Agarwal, A.
Structural, optical and photoconductivity of Sn and Mn doped $TiO_2$ nanoparticles

(2015) *Journal of Alloys and Compounds*, 622, pp. 37-47. Cited 25 times.
doi: 10.1016/j.jallcom.2014.09.218

View at Publisher

55 De Los Santos, D.M., Navas, J., Sánchez-Coronilla, A., Alcántara, R., Fernández-Lorenzo, C., Martín-Calleja, J.
Highly Al-doped TiO2 nanoparticles produced by Ball Mill Method: Structural and electronic characterization

(2015) *Materials Research Bulletin*, 70, pp. 704-711. Cited 9 times.
http://www.sciencedirect.com/science/journal/00255408
doi: 10.1016/j.materresbull.2015.06.008

View at Publisher

56 Zhang, W., Pei, X., Chen, J., He, H.
Effects of Al doping on properties of xAl-3%In-TiO2 photocatalyst prepared by a sol-gel method

(2015) *Materials Science in Semiconductor Processing*, 38, pp. 24-30. Cited 10 times.
doi: 10.1016/j.mssp.2015.04.007

View at Publisher

57 Wu, J., Lo, S., Song, K., Vijayan, B.K., Li, W., Gray, K.A., Dravid, V.P.
Growth of rutile $TiO_2$ nanorods on anatase $TiO_2$ thin films on Si-based substrates

(2011) *Journal of Materials Research*, 26 (13), pp. 1646-1652. Cited 32 times.
doi: 10.1557/jmr.2011.190

View at Publisher

58 Cheng, H., Ma, J., Zhao, Z., Qi, L.
Hydrothermal Preparation of Uniform Nanosize Rutile and Anatase Particles

(1995) *Chemistry of Materials*, 7 (4), pp. 663-671. Cited 706 times.
doi: 10.1021/cm00052a010

View at Publisher

59 Liu, B., Aydil, E.S.
Growth of oriented single-crystalline rutile TiO $_{2}$ nanorods on transparent conducting substrates for dye-sensitized solar cells

(2009) *Journal of the American Chemical Society*, 131 (11), pp. 3985-3990. Cited 1570 times.
http://pubs.acs.org/doi/pdfplus/10.1021/ja8078972
doi: 10.1021/ja8078972

View at Publisher

60 Etacheri, V., Seery, M.K., Hinder, S.J., Pillai, S.C.
Oxygen rich titania: A dopant free, high temperature stable, and visible-light active anatase photocatalyst
(2011) *Advanced Functional Materials*, 21 (19), pp. 3744-3752. Cited 155 times.
doi: 10.1002/adfm.201100301
View at Publisher

61 Shao, Y., Tang, D., Sun, J., Lee, Y., Xiong, W.
Lattice deformation and phase transformation from nano-scale anatase to nano-scale rutile $TiO_2$ prepared by a sol-gel technique
(2004) *China Particuology*, 2, pp. 119-123. Cited 27 times.

62 Selman, A.M., Hassan, Z.
Growth and characterization of rutile TiO2 nanorods on various substrates with fabricated fast-response metal-semiconductor-metal UV detector based on Si substrate
(2015) *Superlattices and Microstructures*, 83, pp. 549-564. Cited 11 times.
http://www.elsevier.com/inca/publications/store/6/2/2/9/4/8/index.htt
doi: 10.1016/j.spmi.2015.04.009
View at Publisher

63 Nemade, K.R., Barde, R.V., Waghuley, S.A.
Liquefied petroleum gas sensing by Al-doped $TiO_2$ nanoparticles synthesized by chemical and solid-state diffusion routes
(2016) *J. Taibah Univ. Sci.*, 10, pp. 345-351. Cited 2 times.

64 Malek, M.F., Mamat, M.H., Khusaimi, Z., Sahdan, M.Z., Musa, M.Z., Zainun, A.R., Suriani, A.B., (...), Rusop, M.
Sonicated sol-gel preparation of nanoparticulate ZnO thin films with various deposition speeds: The highly preferred c-axis (002) orientation enhances the final properties
(2014) *Journal of Alloys and Compounds*, 582, pp. 12-21. Cited 52 times.
doi: 10.1016/j.jallcom.2013.07.202
View at Publisher

65 Filipovic, L., Selberherr, S.
Performance and stress analysis of metal oxide films for CMOS-integrated gas sensors
(2015) *Sensors (Switzerland)*, 15 (4), pp. 7206-7227. Cited 17 times.
http://www.mdpi.com/1424-8220/15/4/7206/pdf
doi: 10.3390/s150407206
View at Publisher

66 Macleod, H.A.
Thin-film Optical Filters
(1986) . Cited 3839 times.
Macmillan Publishing Company

67 Lin, S.-S., Wu, D.-K.
The properties of Al-doped $TiO_2$ nanoceramic films deposited by simultaneous rf and dc magnetron sputtering
(2010) *Ceramics International*, 36 (1), pp. 87-91. Cited 15 times.
doi: 10.1016/j.ceramint.2009.06.023
View at Publisher

68 Miao, L., Tanemura, S., Kondo, Y., Iwata, M., Toh, S., Kaneko, K.
Microstructure and bactericidal ability of photocatalytic TiO2 thin films prepared by rf helicon magnetron sputtering
(2004) *Applied Surface Science*, 238 (1-4 SPEC. ISS.), pp. 125-131. Cited 59 times.
doi: 10.1016/j.apsusc.2004.05.193
View at Publisher

69 Ye, M., Zheng, D., Lv, M., Chen, C., Lin, C., Lin, Z.
Hierarchically structured nanotubes for highly efficient dye-sensitized solar cells
(2013) *Advanced Materials*, 25 (22), pp. 3039-3044. Cited 132 times.
doi: 10.1002/adma.201205274
View at Publisher

70 Shao, F., Sun, J., Gao, L., Yang, S., Luo, J.
Forest-like $TiO_2$ hierarchical structures for efficient dye-sensitized solar cells
(2012) *Journal of Materials Chemistry*, 22 (14), pp. 6824-6830. Cited 85 times.
doi: 10.1039/c2jm15442k
View at Publisher

71 Alam, M.J., Cameron, D.C.
Preparation and properties of transparent conductive aluminum-doped zinc oxide thin films by sol–gel process
(2001) *Journal of Vacuum Science and Technology A: Vacuum, Surfaces and Films*, 19 (4), pp. 1642-1646. Cited 143 times.
doi: 10.1116/1.1340659
View at Publisher

72 Zhang, M., Zhang, M., Shi, S., Song, X., Sun, Z.
An approach toward $TiO_2$ nanostructure growth with tunable properties: Influence of reaction time in a hydrothermal process
(2014) *Journal of Alloys and Compounds*, 591, pp. 213-217. Cited 8 times.
doi: 10.1016/j.jallcom.2013.12.227
View at Publisher

73 Jain, P., Arun, P.
Influence of grain size on the band-gap of annealed SnS thin films
(2013) *Thin Solid Films*, 548, pp. 241-246. Cited 37 times.
doi: 10.1016/j.tsf.2013.09.089
View at Publisher

74 Shen, X., Zhang, J., Tian, B.
Microemulsion-mediated solvothermal synthesis and photocatalytic properties of crystalline titania with controllable phases of anatase and rutile
(2011) *Journal of Hazardous Materials*, 192 (2), pp. 651-657. Cited 43 times.
doi: 10.1016/j.jhazmat.2011.05.066
View at Publisher

75 Gao, Q., Wu, X., Fan, Y., Zhou, X.
Low temperature synthesis and characterization of rutile $TiO_2$-coated mica-titania pigments
(2012) *Dyes and Pigments*, 95 (3), pp. 534-539. Cited 36 times.
doi: 10.1016/j.dyepig.2012.06.006
View at Publisher

76 Oh, S.-M., Ishigaki, T.
Preparation of pure rutile and anatase $TiO_2$ nanopowders using RF thermal plasma

(2004) *Thin Solid Films*, 457 (1), pp. 186-191. Cited 70 times.
doi: 10.1016/j.tsf.2003.12.043

View at Publisher

77 Swamy, V.
Size-dependent modifications of the first-order Raman spectra of nanostructured rutile TiO2

(2008) *Physical Review B - Condensed Matter and Materials Physics*, 77 (19), art. no. 195414. Cited 69 times.
http://oai.aps.org/oai?verb=GetRecord&Identifier=oai:aps.org:PhysRevB.77.195414&metadataPrefix=oai_apsmeta_2
doi: 10.1103/PhysRevB.77.195414

View at Publisher

78 Wang, D., Zhao, J., Chen, B., Zhu, C.
Lattice vibration fundamentals in nanocrystalline anatase investigated with Raman scattering

(2008) *Journal of Physics Condensed Matter*, 20 (8), art. no. 085212. Cited 28 times.
doi: 10.1088/0953-8984/20/8/085212

View at Publisher

79 Zaki, M.I., Katrib, A., Muftah, A.I., Jagadale, T.C., Ikram, M., Ogale, S.B.
Exploring anatase-$TiO_2$ doped dilutely with transition metal ions as nano-catalyst for $H_2O_2$ decomposition: Spectroscopic and kinetic studies

(2013) *Applied Catalysis A: General*, 452, pp. 214-221. Cited 30 times.
doi: 10.1016/j.apcata.2012.12.003

View at Publisher

80 Alamgir, Khan, W., Ahmad, S., Mehedi Hassan, M., Naqvi, A.H.
Structural phase analysis, band gap tuning and fluorescence properties of Co doped TiO2 nanoparticles

(2014) *Optical Materials*, 38, pp. 278-285. Cited 23 times.
doi: 10.1016/j.optmat.2014.10.054

View at Publisher

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