



(51) International Patent Classification:

B01J 35/10 (2006.01) **C01G 23/047** (2006.01)
B01J 21/06 (2006.01) **C02F 1/30** (2006.01)
B01D 53/86 (2006.01) **B01J 19/08** (2006.01)

(21) International Application Number:

PCT/SG2012/000463

(22) International Filing Date:

10 December 2012 (10.12.2012)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

61/568,246 8 December 2011 (08.12.2011) US

(71) Applicant: NATIONAL UNIVERSITY OF SINGAPORE [SG/SG]; 21 Lower Kent Ridge Road, Singapore 119077 (SG).

(72) Inventors: CHEN, Wei; c/o National University of Singapore, Faculty of Science, Department of Chemistry, 21 Lower Kent Ridge Road, Singapore 119077 (SG). RAO, Richuan; c/o National University of Singapore, Faculty of Science, Department of Chemistry, 21 Lower Kent Ridge Road, Singapore 119077 (SG).

(74) Agent: AMICA LAW LLC; 30 Raffles Place, #18-03/04 Chevron House, Singapore 048622 (SG).

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM,

AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

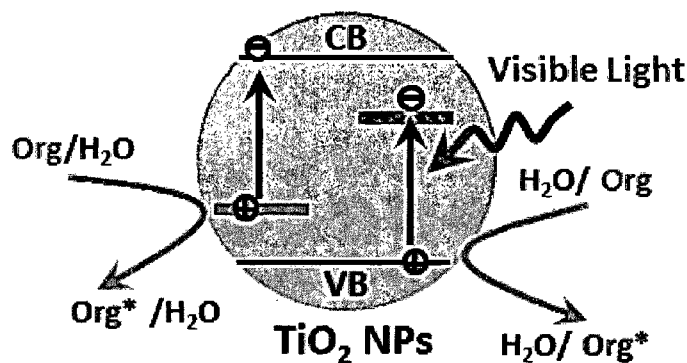
Published:

— with international search report (Art. 21(3))

— before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments (Rule 48.2(h))

(54) Title: PHOTOCATALYTIC METAL OXIDE NANOMATERIALS; METHOD OF MAKING VIA H₂-PLASMA TREATMENT; USE FOR ORGANIC WASTE DECONTAMINATION IN WATER

Photocatalytic Decontamination of Organic Pollutants using Interface Engineered TiO₂ NPs



(57) Abstract: The present invention is directed to black TiO₂ nanoparticles having H₂-plasma induced surface defects. The surface defects generate mid-band gap states, which enable the black TiO₂ nanoparticles to absorb visible and IR light. The enhanced visible and IR light absorption allows the black TiO₂ nanoparticles to serve as photocatalysts in the solar-induced decomposition of pollutant organic compounds in water, an important application in water treatment systems. The present invention is further directed to a method of generating the black TiO₂ nanoparticles utilizing H₂-plasma to introduce surface defects without changing the oxidation state of the titanium in the nanomaterial.