



# €-MRS Spring Meeting 2019

IUMRS - ICAM International Conference on Advanced Materials  
May 27-31 | Acropolis Congress Centre | Nice | France

## SYMPOSIUM H

Materials for applications in photocatalysis and photoconversion

Symposium Organizers :

Anne MORRISSEY, Dublin University, Ireland

Giuliana IMPELLIZZERI, CNR-IMM, Catania, Italy

J. Anthony BYRNE, Ulster University, U.K..

Valérie KELLER, CNRS – University of Strasbourg, France

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09:00	<b>Welcome</b>			14:00	<b>INV Defective Graphenes From Biomass Wastes As Photocatalysts For Solar Fuels Production</b> Hermenegildo Garcia Instituto de Tecnología Química CSIC-UPV, Universitat Politècnica de Valencia, Av. de los Naranjos s/n, 46022 Valencia, Spain	H 3.1
			<b>H2 Production (1) :-</b>			
09:15	<b>INV Photocatalytic Hydrogen Production, TiO2 and C3N4 compared</b> M. Bowker <sup>1,2</sup> , W. Jones <sup>1,2</sup> , A Caravaca <sup>1,3</sup> , D. Martin <sup>1,4</sup> 1. Research Complex at Harwell, Rutherford Appleton Laboratory, Harwell Oxford, Didcot, OX11 0FA, UK, 2. Cardiff Catalysis Institute, School of Chemistry, Cardiff University, Main Building, Park Place, CF10 AT, Cardiff, UK, 3. now at CNRS, IRCELYON, France, 4. now at Johnson Matthey plc, Perstorp, Sweden.	H 1.1		14:30	<b>BiVO4/MeOx Heterogeneous Photoanodes for Efficient Photoelectrochemical Water Splitting via Electrochemical Synthesis</b> Jin Wook Yang, Mi Gyoung Lee, Min-Ju Choi, Ho Won Jang Department of Materials Science and Engineering, Seoul National University, Seoul 08826, Republic of Korea	H 3.2
09:45	<b>HiPIMS deposition of Ta-O-N films for water splitting application</b> J. Capek <sup>1</sup> , ? Batková <sup>1</sup> , J. Houska <sup>1</sup> , S. Haviar <sup>1</sup> , T. Duchos <sup>2</sup> , M. Krba <sup>3</sup> 1 Department of Physics and NTIS - European Centre of Excellence, University of West Bohemia, Plzeň, Czech Republic 2 Department of Surface and Plasma Science, Charles University, Praha, Czech Republic 3 CEMNAT - Center of Materials and Nanotechnologies, University of Pardubice, Pardubice, Czech Republic	H 1.2		14:45	<b>Insights into the role of CuO in the CO2 photoreduction process</b> André E. Nogueira, Jéssica A. Oliveira, Gelson T. S. T. da Silva, Caue Ribeiro Department of Chemistry, Institute of Exact and Biological Sciences (ICEB), Federal University of Ouro Preto, Ouro Preto-MG, Brazil. Chemical Engineering Department, Federal University of São Carlos, São Carlos-SP, Brazil. Department of Chemistry, Federal University of São Carlos, São Carlos-SP, Brazil. Embrapa Instrumentation, São Carlos-SP, Brazil. Forschungszentrum Jülich GmbH, Institute of Energy and Climate Research (IEK-3): Electrochemical Process Engineering, Jülich, Germany.	H 3.3
10:00	<b>Colloidal Bimetallic Nanoparticles for Highly Active Solar Water Splitting and Alcohol Oxidation</b> Félix Urbain <sup>1*</sup> , Ruifeng Du <sup>1</sup> , Pengyi Tang <sup>1,2</sup> , Teresa Andreu <sup>1,3</sup> , A. Cabot <sup>1,4</sup> , Jordi Arbiol <sup>2,4</sup> , and Joan Ramón Morante <sup>1,5</sup> 1 IREC, Catalonia Institute for Energy Research, Jardins de les Dones de Negre 1, 08930 Sant Adrià de Besòs, Barcelona, Catalonia, Spain 2 Catalan Institute of Nanoscience and Nanotechnology (ICN2), CSIC and BIST, Campus UAB, Bellaterra, 08193 Barcelona, Catalonia, Spain 3 Universitat Politècnica de Catalunya, Jordi Girona 1-3, 08034 Barcelona, Catalonia, Spain 4 ICREA, Pg. Lluís Companys 23, 08010 Barcelona, Catalonia, Spain 5 Universitat de Barcelona, Martí i Franquès, 1, 08028 Barcelona, Catalonia, Spain	H 1.3		15:00	<b>Metal-heteropolyacid-titania nanocomposites for enhanced photocatalytic reduction of CO2 to CO in the presence of water</b> Xiang Yu, Vitaly V. Ordonsky, Andrei Y. Khodakov Univ. Lille, CNRS, Centrale Lille, ENSCL, Univ. Artois, UMR 8181 - UCCS - Unité de Catalyse et Chimie du Solide, F-59000 Lille, France	H 3.4
10:15	<b>Coffee break</b>			15:15	<b>Towards Stable and High Efficiency Solution Processed Hybrid Photocathodes for Water Splitting</b> Antonio Alfano, Alessandro Mezzetti, Fabio Di Fonzo Politecnico Di Milano Physics Department, Center For Nano Science and Technology Istituto Italiano di Tecnologia, Center For Nano Science and Technology Istituto Italiano di Tecnologia	H 3.5
			<b>H2 Production (2) :-</b>			
10:45	<b>INV Modifying TiO2 for CO2 conversion and H2 production</b> Michael Nolan Tyndall National Institute, UCC, T12 R5CP, Cork, Ireland	H 2.1		15:30	<b>GRAPHITIC C3N4 FOR CO2 REDUCTION: A PHOTOACTIVITY AND STABILITY STUDY</b> Pomilla, F.R.a,b,c, Cortes, M.A.L.R.M.d, Hamilton, J.W.J.d, Molinari, R.a, Barbieri, G.c, Marci, G.b, Palmisano, L.b, Sharma, P.K.d, Brown, A.d, Byrne, J.A.d a Department of Environmental and Chemical Engineering, University of Calabria, Via Pietro Bucci, Rende CS, 87036, Italy b Schiavello-Grillone Photocatalysis Group. Dipartimento di Energia, Ingegneria dell'Informazione e Modelli Matematici (DEIM), Università di Palermo Viale Delle Scienze, Palermo, 90128, Italy c Institute on Membrane Technology (ITM-CNR), National Research Council C/o, University of Calabria, Cubo 17C, Via Pietro Bucci, Rende CS, 87036, Italy	H 3.6
11:15	<b>Design and investigation of pure anatase, rutile and brookite phases TiO2 photoanodes for water splitting application</b> Antoine Deswaziere, Olivier Durupthy, Christel Laberty - Robert Sorbonne Université, Laboratoire de Chimie de la Matière Condensée de Paris, LCMCP, F-75005 Paris, France	H 2.2		15:45	<b>Z-Schematic CO2 reduction using H2O electron donor by a mixture of Ru-complex/(CuGa)1-xZn2xS2 and BiVO4 particle photocatalysts</b> Tomiko M. Suzuki <sup>1</sup> , Shunya Yoshino <sup>2</sup> , Tomoaki Takayama <sup>2</sup> , Akihide Iwase <sup>2</sup> , Akihiko Kudo <sup>2</sup> , Takeshi Morikawa <sup>1</sup> 1 Toyota Central R&D Labs., Inc., Nagakute, Aichi, 480-1192, Japan, 2 Department of Applied Chemistry, Faculty of Science, Tokyo University of Science, 1-3 Kagurazaka, Shinjuku-ku, Tokyo 162-8601, Japan	H 3.7
11:30	<b>LaFeO3/g-C3N4 heterostructured thin film photocatalysts for hydrogen production via water splitting</b> Raphaël Schninder <sup>1</sup> , Thomas Gries <sup>2</sup> 1: Laboratoire Réactions et Génie des Procédés, Université de Lorraine, CNRS UMR 7274, Nancy, France, 2: Institut Jean Lamour, Université de Lorraine, CNRS UMR 7198, Nancy, France	H 2.3		16:00	<b>Coffee Break</b>	
11:45	<b>Advanced photothermal activity of noble-metal-free Ti@TiO2 nanoparticles for hydrogen production from aqueous solutions</b> Sergey Nikitenko, Tony Chave, Sara El Hakim ICSM, UMR 5257, CEA, CNRS, ENSCM, Univ Montpellier, Marcoule, France	H 2.4				
12:00	<b>Visible light photocatalysis with main group octahedral sulphides</b> R. Lucena <sup>[1]</sup> , F. Fresno <sup>[1]</sup> , P. Palacios <sup>[2]</sup> , P. Wahnón <sup>[2]</sup> , J.C. Conesa <sup>[1]</sup> [1] Instituto de Catálisis y Petroleoquímica, CSIC, Madrid, Spain, [2] Instituto de Energía Solar, Universidad Politécnica de Madrid, Spain	H 2.5		16:30	<b>Various Metal Plasmonic Nanostructure Effects on the Photocatalytic Ability of Hematite Electrodes.</b> J. Horne, M. Forster, A. Cowan, F. Jaeckel University of Liverpool	H P1.1
12:15	<b>INV Molecular approaches toward hydrogen production in photoelectrochemical cells</b> M. Chavarot-Kerlidou Laboratory of Chemistry and Biology of Metals, Univ. Grenoble Alpes, CNRS & CEA, Grenoble, France	H 2.6		16:30	<b>Study photo-electrochemical properties of Orthorhombic Hybrid Perovskite MAPbI3: The Potential Application as a Photocatalyst</b> A. Al-Shami <sup>(1,4)</sup> , A. Benyoussef <sup>(1,2)</sup> , A. El Kenz <sup>(2)</sup> , H. Ez-zahraouy <sup>(1)</sup> , M. Hamedoun <sup>(2)</sup> , A. Ennaoui <sup>(3)</sup> , and O. Mounkachi <sup>(1)</sup> , (1)- Laboratory of Condensed Matter and Interdisciplinary Sciences (LaMCScl), B.P. 1014, Faculty of Science-Mohammed V University, Rabat, Morocco. (2)- Materials and Nanomaterials Center, MASCIr Foundation, Rabat Design Center, Rue Mohamed Al Jazouli, Madinat Al Irfane, Rabat 10 100 – Morocco. (3)- Institut de Recherche en Energie Solaire et Energies Nouvelles (IRESEN), Morocco. (4)- Department of Physics, Faculty of Science, Sana'a University, Sana'a, Yemen.	H P1.2
12:45	<b>LUNCH</b>					

Pomilla, F.R.<sup>a,b,c</sup>, Cortes, M.A.L.R.M.<sup>d</sup>, Hamilton, J.W.J.<sup>d</sup>, Molinari, R.<sup>a</sup>, Barbieri, G.<sup>c</sup>, Marci, G.<sup>b</sup>, Palmisano, L.<sup>b</sup>, Sharma, P.K.<sup>d</sup>, Brown, A.<sup>d</sup>, Byrne, J.A.<sup>d</sup>

<sup>a</sup> Department of Environmental and Chemical Engineering, University of Calabria, Via Pietro Bucci, Rende CS, 87036, Italy

<sup>b</sup> Schiavello-Grillone Photocatalysis Group. Dipartimento di Energia, Ingegneria dell'Informazione e Modelli Matematici (DEIM), Università di Palermo Viale Delle Scienze, Palermo, 90128, Italy

<sup>c</sup> Institute on Membrane Technology (ITM-CNR), National Research Council C/o, University of Calabria, Cubo 17C, Via Pietro Bucci, Rende CS, 87036, Italy

<sup>d</sup> NIBEC, Ulster University, Newtownabbey, BT37 0QB, United Kingdom

## **GRAPHITIC C<sub>3</sub>N<sub>4</sub> FOR CO<sub>2</sub> REDUCTION: A PHOTOACTIVITY AND STABILITY STUDY**

The increasing CO<sub>2</sub> concentration in the atmosphere exerts a significant influence on climate change, for this reason the capture and utilisation by using renewable energies of CO<sub>2</sub> is a scientific and technical challenge. In this work, the photocatalytic reduction of CO<sub>2</sub> was investigated by using graphitic carbon nitride (g-C<sub>3</sub>N<sub>4</sub>). The g-C<sub>3</sub>N<sub>4</sub> powder was immobilized on a glass support and inserted in a custom built photocatalytic batch reactor equipped with UV-Vis irradiation. The experiments were carried out at 70°C and an initial pressure of 2.5 bar. The production of CO was observed when the photocatalytic reaction was performed in the presence of CO<sub>2</sub> and H<sub>2</sub>O vapour. However, the rate of CO production was found to decline over time. Oxygen doped g-C<sub>3</sub>N<sub>4</sub> (O<sub>T</sub>-C<sub>3</sub>N<sub>4</sub>) was also prepared and tested as a photocatalyst showing a similar trend to the unmodified material but with lower conversions. Repeated cycles of CO<sub>2</sub> reduction experiments showed a further decline in activity. In the absence of CO<sub>2</sub> some CO generation was observed, indicating potential photooxidation of catalyst. By FTIR and XPS analysis the increasing in the oxygen functional groups in the g-C<sub>3</sub>N<sub>4</sub>, generated through UV-Vis irradiation or intentional doping, was found to be detrimental for the photoreduction of CO<sub>2</sub> to yield CO. This work highlights [1] the need for replicates and control testing methodologies in CO<sub>2</sub> reduction tests to study photocorrosion in non-oxide photocatalysts.