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Sajjad Ullah, PhD

I am serving as Assistant Professor (Chemistry) at Institute of Chemical Sciences, University of Peshawar (ICS-UoP), Pakistan. I did my PhD from Institute of Chemistry of Sao Carlos (IQSC), University of Sao Paulo (USP) Brazil (2014) in Inorganic-Analytical Chemistry and my master in chemistry (M.Sc) from UCS-UoP Pakistan (2006). I have recently completed my postdoctoral studies (2016-18) from State University of Sao Paulo, Brazil. I have around 11 years of teaching/research experience at 05 different Public sectors universities of Pakistan and Brazil. My research is focused on the development of novel photoactive materials (nanoparticles, membranes, thin films) for environmental remediation using UV/Vis/NIR radiation. I have published 14 research articles in international journals with a total impact factor of 59.4 and total number of citation equal to 136 ([GoogleScholar](#), 29-10-2018).

Academic Record

Postdoctoral Studies, Chemistry, Institute of Chemistry of Araraquara, State University of São Paulo, Araraquara, SP, Brazil (June 2016-September 2018).

Project title: *Development of efficient IR/Visible light-driven Photocatalysts for Photocatalytic Applications under Solar light radiation*, Supported by [Sao Paulo Research foundation \(FAPESP\)](#), Supervisor: Prof. Dr. Sidney Jose Lima Ribeiro

Doctor of Philosophy (PhD), Chemistry, Institute of Chemistry of São Carlos, University of São Paulo, SP, Brazil **2010-2014**, under *TWAS/CNPq Fellowship*

Thesis title: *Preparation and Characterization of Nanostructured Materials and thin films based on TiO₂ for Application in Photocatalysis for environmental clean-up* (DOI: 10.11606/T.75.2014.tde-26012015-173233) (click [here](#) to view thesis), Supervisor: Prof. Dr. Ubirajara Pereira Rodrigues-Filho

Master of Science, Chemistry, [University of Peshawar](#), Peshawar, Pakistan **2004-2007**

- Got 1st division and secured 5th position in master level examination.

Bachelor of Science (B.Sc), Chemistry, [University of Peshawar](#), Pakistan **2002-2004**

- Got 1st division and secured 1st Position in the college in bachelor level examination

Bachelor in Education (B.Ed), [University of Peshawar](#), Pakistan **2007-08**

Higher Secondary School Certificate (HSSC), pre-medical, Board of Intermediate and Secondary Education ([BISEP](#)), Peshawar, Pakistan **2000-2002**

Secondary School Certificate (SSC), science, Board of Intermediate and Secondary Education (BISEP), Peshawar, Pakistan **1998-2000**

Professional Record/Experience

Assistant Professor in Chemistry (Current/Permanent): Institute of Chemical Sciences, University of Peshawar, Peshawar, KPK Pakistan **(01-01-2010 to date)**

- Teaching *analytic chemistry, spectroscopic, chromatographic and electro-analytical techniques to graduate students and supervision of their research project/laboratory work/activities*

Lecturer in Chemistry (past): Abdul Wali Khan University, Department of Chemistry, Mardan, KPK, Pakistan **08/2009 - 12/2009**

- Teaching *analytic chemistry, spectroscopic and electro-analytical techniques to graduate students and supervision of their laboratory work/activities*

Lecturer in Chemistry (past): University of Science and Technology Bannu (USTB), KPK, Pakistan **01/2008 - 08/2009**

- Teaching *analytic chemistry, spectroscopic, chromatographic and electro-analytical techniques to graduate students and supervision of their laboratory work/activities*

Lecturer in Chemistry (past): Government Degree College Tangi, Tangi, Charsadda, KPK, Pakistan **03/2007 - 01/2008**

- Teaching *General Chemistry to undergraduate and graduate students and supervision of their laboratory work/activities*

Visiting Foreign Faculty: Institute of Chemistry of Araraquara, State University of São Paulo, Araraquara, SP, Brazil **02/2018 - 06/2018**

- Teaching *General Inorganic Chemistry Course to undergraduate and graduate students*

Administrative Experience

Warden Student Hostel: University of Science and Technology Bannu, KPK, Pakistan **03/2008 - 08/2009**

- *Administration of students' accommodation and arrangement of food at student hostels*

Member of Seminar/conference committee: University of Peshawar, KPK, Pakistan **09/2014 - present**

- *Organizing departmental events/seminars/workshops at Institute of Chemical Sciences, University of Peshawar*

Departmental Website Administrator: Institute of Chemical Sciences, University of Peshawar, KPK, Pakistan **09/2014 - present**

Focal Person of the ORIC: Focal person at the Office of Research, Innovation and Commercialization (ORIC) at University of Peshawar, KPK, Pakistan **09/2014 - present**

Journal Reviewer: Spectrochimica Acta Part A; Carbohydrate Polymers, Brazilian Journal of Chemical Engineering

Awards, Distinctions and Fellowships

- [FAPESP Postdoctoral Fellowship Award](#), 2016, Sao Paulo Research Foundation, Brazil
- *Selection as young scientist for participation in [TWAS/BVA.NXT 2016](#) and [Biovision Alexandria, Alexandria, Egypt, 10-14 April, 2016](#)*
- *Selection as young scientist for participation in [65th Lindau Nobel Laureate Meeting 2015](#), Lindau Germany, June 28-July 03, 2015*
- [TWAS-CNPq Postgraduate Fellowship Award](#), 2010-2014
- *President Talent Forming Scheme Award, [Higher Education Commission Pakistan](#), 2005 and 2006*
- *1st division throughout academic career*

Research Interests / Research Profile

- *Development of UV/visible light active nanometric semiconductor photocatalysts for pollutants degradation and environmental clean-up*
- *ORMOSIL-polyoxometalates hybrid photoactive materials*
- *Thin photoactive/self-cleaning films preparation*
- *Synthesis of core @shell nanoparticles*
- *Water purification*
- *Sol-gel chemistry*
- *Photocatalysis*

Quantitative Indicators

Research articles published: 14
Total Impact factor: 59.39
Research article under review/in process: 04
Total Citation = 129 (GoogleScholar)
Master Thesis supervised = 04
M.Phil/PhD Thesis under-supervision = 02

List of Publications/Patents

Published Research Articles

1. **Sajjad Ullah**, E.P. Ferreira-Neto et. al, [Broad spectrum photocatalytic system based on BiVO₄ and NaYbF₄:Tm³⁺ upconversion particles for environmental remediation under UV-visible-NIR illumination](#), **2018**, Applied Catalysis B: Environmental (DOI: [10.1016/j.apcatb.2018.09.091](#))
2. Mateus B. Simões, **Sajjad Ullah**, Chanchal Hazra, Michel Wong Chi Man, Sidney JL Ribeiro, U. P. Rodrigues-Filho, Eco-friendly Polydimethylsiloxane-Based Self-Supporting Film containing Europium-Polyoxometalate: A Flexible Luminescent Material for White Light Generation **2018**, Journal of Luminescence (DOI: [10.1016/j.jlumin.2018.04.041](#))
3. Chanchal Hazra, **Sajjad Ullah**, Laís, G. Caetano, York E. Serge Correales, Sidney J. L. Ribeiro, Enhanced NIR-I Emission from Water-Dispersible NIR-II Dye-sensitized Core/Active Shell Upconverting Nanoparticles, **2018**, Journal of Mat Chem C (DOI: [10.1039/C8TC00335A](#))
4. Chanchal Hazra, **Sajjad Ullah**, Laís Galvão Caetano and Sidney JL Ribeiro, *Eu (III)-Coordination Polymer Sub-micron Fibers: Material for Selective and Sensitive*

- Detection of Cu²⁺ ions via Competition between Photoinduced Electron Transfer and Energy Transfer*, Journal of Material Chemistry C, **2018**,6, 153-161 [DOI: 10.1039/C7TC02638B]
5. A. Staykov, E.P. Ferreira-Neto, J.M.Y Santa-Cruz, **Sajjad Ullah**, U. P. Rodrigues-Filho, *The stability of titania-silica interface*, Int J Quantum Chem. **2017**; e25495 [DOI: 10.1002/qua.25495]
 6. **Sajjad Ullah**, C.Hazra, E.P. Ferreira-Neto, T.C. Silva, U.P. Rodrigues-Filho, S.J. L. Ribeiro, *Microwave-assisted synthesis of NaYF₄:Yb³⁺/Tm³⁺ upconversion particles with tailored morphology and phase for the design of UV/NIR-active NaYF₄:Yb³⁺/Tm³⁺@TiO₂ core@shell photocatalysts*, CrystEngComm 19, 3465-3475, **2017**, [DOI: 10.1039/C7CE00809K]
 7. **Sajjad Ullah**, Elias P Ferreira-Neto, André A Pasa, Carlos CJ Alcântara, José JS Acuña, Sara A Bilmes, Maria L Martínez Ricci, Richard Landers, Taina Z Fermino, Ubirajara P Rodrigues-Filho. *Enhanced Photoactivity of core@shell SiO₂@TiO₂*, Applied Catalysis B: Environmental 179, 333–343, **2015**. [DOI:10.1016/j.apcatb.2015.05.036]
 8. Rashida Parveen, Janaina Fernandes Gomes, **Sajjad Ullah** and Germano Tremiliosi-Filho, *One-pot synthesis of single crystalline gold nanorods using glycerol in alkaline media as a low-cost and eco-friendly reducing agent*, **2015**, Journal of Nanoparticles Research,17 (10), 418, **2015**, [doi: 10.1007/s11051-015-3223-y]
 9. Elias P. Ferreira Neto, Mateus B. Simões, Julia Cristina Noveletto, Jean M. S. C. Yabarrena, **Sajjad Ullah** and Ubirajara P. Rodrigues Filho, *The effect of ormosil matrix composition and alkaline-earth cations doping on the photochromic response of sol-gel derived ormosil-polyoxometalate hybrid films* **2015**, Journal of the Brazilian Chemical Society [DOI: 10.5935/0103-5053.20150282] (IF=1.096)
 10. Lidiane P. Gonçalves, Elias. P. Ferreira-Neto, **Sajjad Ullah**, L. V Souza, Orlando E Ysnaga, Ubirajara P Rodrigues-Filho, *Enhanced Photochromic Response of Phosphotungstate-ormosil Nanocomposite Coatings doped with TiO₂ Nanoparticles*, Journal of Sol Gel Science and Technology, 76(2), 368-395, **2015** [DOI: 10.1007/s10971-015-3787-0]
 11. Elias P Ferreira-Neto, **Sajjad Ullah**, Flavio LS de Carvalho, Adriano L de Souza, Marcos de Oliveira, José F Schneider, Yvonne P Mascarenhas, Alberto M Jorge, Ubirajara P Rodrigues-Filho. *Preparation, characterization and photochromic behaviour of phosphotungstic acid-ormosil nanocomposites*, Journal of Material Chemistry and Physics, 153, 410-421, **2015** [DOI 10.1016/j.matchemphys.2015.01.035]
 12. Elias P Ferreira-Neto,**Sajjad Ullah**, Orlando A. E Ysnaga, Ubirajara Pereira Rodrigues-Filho, *Zn²⁺ doped ormosil–phosphotungstate hybrid films with enhanced photochromic response*, Journal of Sol-Gel Science and Technology, 72(2), 290-300, **2014** [DOI 10.1007/s10971-014-3404-7]
 13. Elias P Ferreira-Neto, Flavio LS de Carvalho, **Sajjad Ullah**, Vinicius C Zoldan, André A Pasa, Adriano Lopes de Souza, Liliane C Battirola, Petra Rudolf, Sara Aldabe Bilmes, Ubirajara P Rodrigues-Filho. *Surface structure and reactivity study of phosphotungstic acid-nitrogenated ormosils*, Journal of Sol-Gel Science and Technology, 66 (3), 363-371, **2013** [DOI: 10.1007/s10971-013-3018-5]

14. **Sajjad Ullah**, José Javier Sáez Acuña, André Avelino Pasa, Sara A Bilmes, Maria Elena Vela, Guillermo Benitez, Ubirajara Pereira Rodrigues-Filho. *Photoactive layer-by-layer films of cellulose phosphate and titanium dioxide containing phosphotungstic acid*, Applied Surface Science 277, 111-120, **2013** [DOI: 10.1016/j.apsusc.2013.04.011]

Patent(s):

1. Monodisperse sub-nanometric anatase crystals of high thermal stability for advance applications (*Patent in Preparation*)

Lists of Research Projects Supervised

I have already supervised the research projects of 03 master degree students while supervision of 02 M.Phil/PhD students is currently in progress (expected to be concluded by December 2018) at the Institute of Chemical Sciences, [University of Peshawar](#) (UoP), Pakistan. The projects are not fully-funded and essential infrastructure and reagents are provided by the Institute of Chemical Sciences.

Thesis/Dissertation supervised (completed):

1. **RAHMUL KABIR**, *Modification of Bacterial Cellulose Membranes with Silver and Titanium dioxide Nanoparticle and its antibacterial activity*, **2015**, Master degree thesis, Institute of Chemical Sciences, University of Peshawar, Pakistan
2. **MUHAMMAD DANIAL**, *Green synthesis of SDS-stabilized gold and silver nanoparticles using glycerol as reducing agent*, **2015**, Master degree thesis, Institute of Chemical Sciences, University of Peshawar, Pakistan
3. **SALEEM UR REHMAN**, *The effect of metals impregnation on adsorption and photocatalytic activity of titanium dioxide (TiO₂)*, **2016**, Master degree thesis, Institute of Chemical Sciences, University of Peshawar, Pakistan
4. **YORK ESTEWIN SERGE CORREALES**, *Desenvolvimento de Fluoretos Dopados com Íons Lantanídeos para Aplicações Fotocatalíticas via Conversão Ascendente de Energia = Development of Lanthanide Ions doped Fluoride based Upconversion Nanoparticles for Photocatalytic Applications*, **2018**, Master degree thesis (co-supervision), Institute of Chemistry of Araraquara, State University of São Paulo, Araraquara, SP, Brazil (June 2016-September 2018).

Thesis under Supervision (in Progress)

1. **GHAWS UR RAHMAN**, **Development of metal oxides nanostructured materials for photocatalytic removal of dyes from aqueous solution** (in progress, expected to be concluded by August 2018), M.Phil degree thesis, Institute of Chemical Sciences, University of Peshawar, Pakistan

2. KIFAYAT UR RAHMAN, **Development of self-cleaning, photocatalytic and antibacterial composite self-supporting membranes based on bacterial cellulose and metal/metal oxides**, (in progress, expected to be concluded by August 2018), M.Phil degree thesis, Institute of Chemical Sciences, University of Peshawar, Pakistan

Participation/Presentation in Scientific events/Conferences

1. **ULLAH, Sajjad**, C. Hazra, E. P. F. Neto, U.P. Rodrigues-Filho, S.J. L. Ribeiro, *Broad-spectrum UV-to-NIR-active photocatalyst based on semiconductors and lanthanides-doped upconversion crystals*, 8th International Conference on Optical, Optoelectronic and Photonic Materials and Applications, Maresias-SP (Brazil), August 26th to 31st **2018** (Oral presentation)
2. **ULLAH, Sajjad**, C. Hazra, E. P. F. Neto, U.P. Rodrigues-Filho, S.J. L. Ribeiro, *Novel Hybrid Titania and Non-titania Photocatalytic systems for Photocatalysis under UV, Visible and Near-infrared Irradiation*, 10th European meeting on Solar Chemistry and Photocatalysis: Environmental Applications (SPEA10), held in Almería, Spain, on June 4th – 8th **2018** (Oral presentation)
3. **ULLAH, Sajjad**, C. Hazra, E. P. F. Neto, T. Castro, U.P. Rodrigues-Filho, S.J. L. Ribeiro, *Phase and shape-controlled synthesis of NaYF₄: Yb³⁺/Tm³⁺ NIR-to-UV/Vis upconversion particles for the design of UV/NIR-active TiO₂-based photocatalysts*, 10th International conference on Nanophotonics (ICNP), July 2-5, **2017**, Recife, PE-Brazil (Oral Presentation).
4. **ULLAH, Sajjad**, Chanchal Hazra, Rodrigues-FILHO, U. P., Ribeiro, Sidney J. L. Ribeiro, *Near-infrared active NaYF₄: Yb³⁺/Tm³⁺@TiO₂ photocatalyst with tailored morphology for photocatalytic applications using solar light*, **2016**, XVIII Brazilian Meeting on Inorganic Chemistry, September 2016, Sao Pedro, Brazil (Oral Presentation)
5. **ULLAH, Sajjad**, Rodrigues-FILHO, U. P. *An understanding of the effect of Core@shell Configuration on the Optical and Photocatalytic properties of Silica-supported TiO₂*, **2016**, 4th International conference on Environmental Horizons, University of Karachi, Pakistan (Oral Presentation)
6. Participation as young scientist in 65th Nobel Laureate Meeting 2015 Lindau Germany, June 28-July 03, **2015**
7. **ULLAH, Sajjad**, PASA, A., ACUNA, J. J. S., BILMES, SARA A., Rodrigues-FILHO, U. P. *Low temperature phase selective synthesis and characterization of core@shell SiO₂@TiO₂ nanoparticles: the effect of shell-thickness and morphology on photoactivity and band-gap energy*, **2014**, 2014 MRS Spring Meeting & Exhibit, San Francisco, California
8. FERREIRA-NETO, Elias P., **ULLAH, Sajjad**, Rodrigues-FILHO, U. P., Ysnaga O A L, *Highly photochromic divalent metal doped ormosil-phosphotungstate hybrid films*, **2014**, 2014 MRS Spring Meeting & Exhibit, San Francisco, California
9. FERREIRA-NETO, Elias P., **ULLAH, Sajjad**., Ysnaga O A L, Rodrigues-FILHO, U. P. *Micro-XRF and XANES Study of Zn-doped ormosil-phosphotungstate hybrid films with enhanced photochromic response*, **2014**, 24th Annual User Meeting (RAU), Brazilian Synchrotron Light Laboratory (LNLS/CNPEM), Campinas, SP, Brazil

10. **ULLAH, Sajjad**, ACUNA, J. J. S., PASA, A., BILMES, SARA A., VELA, M. E., B. Guillermo, Rodrigues-FILHO, U. P. *Preparation, Characterization and Photoactivity of multilayer films of TiO₂ and Polyoxometalates prepared using cellulose phosphate as an efficient binder molecule*, 2014, 1st international symposium on nanoparticles/nanomaterials and applications, Caparica, Portugal. (Oral Presentation)
11. **ULLAH, Sajjad**, Rodrigues-FILHO, U. P., Photocatalytic, Self-cleaning and Optical properties of Silica/Titania hybrid Nanoparticles, **2013**, 4th Meeting of nBioNet: Films and Sensors Network 2013, São Pedro, SP, Brazil.
12. **ULLAH, Sajjad**, ACUNA, J. J. S., Rodrigues-FILHO, U. P., *Physical Characterization of Titania-polyoxometalates LbL film by Electron Microscopy*, **2013**, XII Meeting of SBPMat, Campos Do Jordão, SP, Brazil.
13. **ULLAH, Sajjad**, PORFIRIO, B. F. C., Rodrigues-FILHO, U. P., *Soft Hydrothermal Treatment and Water-Induced Crystallization of Non-crystalline Titania as Greener, Phase-selective Routes for Anatase Synthesis*, **2013**, XII Meeting of SBPMat, Campos Do Jordão, SP, Brazil.
14. **ULLAH, Sajjad**, Rodrigues-FILHO, U. P., *Synthesis, Characterization and Photoactivity of Core-shell SiO₂@TiO₂ nanoparticles*, **2013**, XII Meeting of SBPMat, Campos Do Jordão, SP, Brazil (Oral Presentation).
15. **ULLAH, Sajjad.**, PORFIRIO, B. F. C., GONCALVES, L. P., RODRIGUES-FILHO, U. P. Effect of Hydrothermal Treatment on crystallinity of TiO₂, **2012**, Evento: XIV simpósio de Ciência e Engenharia de Materiais, Universidade de São Paulo, São Carlos, SP, Brazil.
16. **ULLAH, Sajjad**, RIBEIRAO, S. J. L., ACUNA, J. J. S., PASA, A., Rodrigues-FILHO, U. P., Preparation and Characterization of Photoactive LbL films of TiO₂ on Bacterial cellulose, **2012**, XI Encontro da SBPMat, Florianópolis.
17. **ULLAH, Sajjad.**, ACUNA, J. S., Rodrigues-FILHO, U. P., *TEM study of Titaniumdioxide-Polyoxometalatesnanocomposite*, **2012**, II USP Conference on Nanotechnology, Broa, Itirapina, SP, Brazil.
18. **ULLAH, Sajjad**, Rodrigues Filho, U.P., IMASATO, H., J.L. S., *Phosphotungstic Acid Self-Assembling on Titanium Dioxide covered with cellulose phosphate*, **2011**, nBioNet Workshop, Hotel Estância Atibainha, SP, São Carlos.
19. **ULLAH, Sajjad.**, RIBEIRAO, S. J. L., ACUNA, J. J. S., PASA, A., RODRIGUES-FILHO, U. P. *Photodegradation of Crystal Violet on nanostructured films of Titanium dioxide formed on different substrates using the LbL assembly technique*, **2011**, International and 22nd National Chemistry Conference, Department of Chemistry and Biochemistry, University of Agriculture Faisalabad, Pakistan.
20. **ULLAH, Sajjad.**, Rodrigues Filho, U.P., *Preparation and Characterization of Phosphotungstic acid-loaded TiO₂ LBL Films Using Two Different Polyelectrolytes*, **2011**, nBioNet Workshop 2011, Atibainha, Dom Pedro, SP, Brazil

Personal Links:

<http://www.uop.edu.pk/departments/Teaching-Faculty/?r=228&q=DrSajjad-Ullah> (**Professional**)

<http://www.researcherid.com/rid/D-9782-2014> (**MyResearcherID**)

https://scholar.google.com.br/citations?user=rMBEW_0AAAAJ&hl=en (**MyCitations**)

https://www.researchgate.net/profile/Sajjad_Ullah2 (**Researchgate**)

<https://sites.google.com/site/sajjadullahresearchgroup/research-projects> (**Personal**)

Training received and Skills acquired

1. Training of Transmission Electron Microscopy (JEOL 200 KeV) and TEM data treatment at Federal University of Santa Catharina, Florianopolis, Brazil
2. Training of Scanning Electron Microscopy: I have had a short training on operation and use of Field emission gun-scanning electron microscope (FEG-SEM) at federal university of Sao Carlos, Sao Paulo Brazil.
3. Use of various instruments such as X-ray Diffractometer, particle size analyzer based on dynamic light scattering, Xe arc lamp and radiometer, FTIR, scanning electron microscope, Transmission electron microscope, UV-Vis spectrophotometers, Raman spectrophotometer; data treatment and interpretation using all these techniques.
4. Use of data treatment softwares, Origin Pro8, Winspec for treatment of XPS data, Photoscape, ImageTool (particle size measurements) and Digital Micrograph by Gatan (HRTEM image analysis)
5. Use of Turnitin Software for checking plagiarism at UNESP, Brazil, 27 Nov 2018.

Languages Proficiency

Highly proficient in **English, Urdu, Pashto and Portuguese**

References

• **Prof. Dr. Ubirajara Pereira Rodrigues-Filho**, Associate Professor, Institute of Chemistry of São Carlos, University of São Paulo, SP, Brazil, uprf@iqsc.usp.br. +55-16-33739439

• **Prof. Dr. Sidney Jose Lima Ribeiro**, Full Professor, State University of Sao Paulo (UNESP), Institute of Chemistry of Araraquara, SP, Brazil. sidney@iq.unesp.br

Biography and Professional Summary (Dr. Sajjad Ullah)

I am a regularly employee of the currently University of Peshawar since 2010, currently serving as Assistant Professor in Chemistry at [Institute of Chemical Sciences](#), University of Peshawar, Pakistan. I did my PhD from University of Sao Paulo, Brazil in 2014 under TWAS-CNPq postgraduate fellowship program and have recently completed my postdoctoral studies (2016-18) from State University of Sao Paulo (UNESP), SP, Brazil. I did my B.Sc (2004) and M.Sc Chemistry (2006) from [University of Peshawar](#) (UoP), Pakistan.

Fast forward, after completion of my PhD, I got appointed as assistant Professor (BPS 19, full time, permanent) at [Institute of Chemical Sciences](#), University of Peshawar, Pakistan where I am still serving at the same post. Before this, I have served as Lecturer in Chemistry (BPS 18) at two national Universities of Pakistan.

At UoP, I have supervised the research work of 03 master students and am currently supervising 02 M.Phil students who are expected to defend their thesis in August 2018. I have published 13 research articles in reputed international journals with a total impact factor of 47.7 and total citation of 115. I am reviewer of three international journals and Guest Editor of two others. My Research is mainly focused on the development of UV/Vis/NIR-active nanometric semiconductor photocatalysts for environmental remediation.

I have been active part of Office of Research Innovation & Commercialization (ORIC, UoP) aiming at bringing academia-industry close so that more students have the opportunity of higher education/research. ORIC policy includes translation of research into the public benefit and we particularly focus on the university-industry relationships so as scientific research can be utilized for the uplift of the society. At ORIC we devise such policies as to promote scientific culture in the University (UoP). I am also a member of the provincial team (KPK team) of National Academy of Young Scientists, actively involved in conduction of seminars on higher education opportunities and the importance of science for the progress of the country and address national issues. To train young students for research career and the use of research tools, I have also started a series of seminars on topics such as “how to get higher education abroad” and “the effective use scientific tools and procedures”.

I have research collaborations with researchers from Pakistan, Germany (Michael Noeske, IFAM), Portugal (Prof. Ana Maria Botelho do Rego), Argentine (Prof. Sara A Bilmes, Universidad de Buenos Aires), Peru (Prof. Juan Rodrigues, Universidade Nacional Ingenieria) and Japan (Prof. Aleksandar Saykov, Kyushu University).

Based on my research outcomes and academic productivity, I was globally selected as young scientist for participation in [65th Lindau Nobel Laureate meeting \(2015\)](#) in Lindau Germany and [TWAS/BVA.NXT 2016](#) and BiovisionAlexandria Meeting (2016) in Egypt. I

had also been granted [Higher Education Commission \(HEC\) President Talent Forming Award](#). Recently, my research project based on *the development of visible and infrared light active photocatalysts for the photocatalytic cleaning of drinking water using solar light* was selected for the award of [FAFESP Postdoctoral fellowship award](#) (2016-2018). The project is progress and we have obtained promising initial results. The idea is to prepare such photocatalytic reactor system that can utilize infrared and visible light portion of the solar spectrum (which is around 95% of total) for disinfection and photocatalytic cleaning of drinking water. Social impact and importance of the project is obvious from the fact that around 844 million people still lack ready access to improved sources of drinking and 2.5 billion people do not use an improved sanitation facility (UNO report 2017).

Recently, in June 2017, my research project base on photoactive optical fibers for the design of advance photocatalytic system for water purification was accepted for the award of [FAPESP fellowship abroad](#) which was supposed to be executed in Canada's Excellence Research Chair in Photonics Innovations (CERC), Center for Optics, Photonics and Lasers (COPL) at Laval University Quebec, in collaboration with the industrial partner (EXP Inc., Brampton ON, Quebec QC). However, due to some other issues, I had to get off the project.

Short Summary of Each Project of Dr. Sajjad Ullah

Project 1: Development of Efficient IR/Visible light-driven Photocatalysts for Photocatalytic Applications under Solar light radiation

This project, supported by Sao Paulo Research Foundation (FAPESP, grant number 2015/22875-4) has recently been won by the applicant (Dr. Sajjad Ullah, as PI) for his postdoctoral studies (June 2016-June 2018) at State University of Sao Paulo (UNESP), Brazil in Professor Sidney Jose Lima Ribeiro's group. The total amount of the funds awarded is around 50,000 USD.

Heterogeneous photocatalysis based on semiconductor materials, especially TiO_2 , is an efficient method for environmental clean-up. However, practical applications of semiconductor photocatalysts, beside other factors such as recombination of charge carriers (e^- - h^+ recombination), are limited by the requirement of continuous supply of UV light, which is only around 6% of the solar spectrum. The development of TiO_2 based composite photocatalysts responsive towards visible and near infrared (NIR) radiation is thus of immense importance. In this project, attempts will be made to extend the application of TiO_2 to visible and IR region of the spectrum by preparing two types of composite photocatalysts with a core@shell configuration: (1) Visible light-driven photocatalysts (VLPC), with an architecture represented as $\text{SiO}_2@ \text{WO}_3@ \text{TiO}_2/ \text{Ag}$ and (2) NIR light-driven photocatalysts (IRLPC) represented as $\text{UC}@ \text{TiO}_2$ or $\text{UC}@ \text{WO}_3$ where UC is an *upconversion* (UC) material like $\text{NaYF}_4: \text{Nd}^{3+}: \text{Yb}^{3+}, \text{Tm}^{3+}$. In case of VLPC, the active components (WO_3 , TiO_2 and Ag) will be supported on SiO_2 sub-micron particles in a core@shell configuration based on our previously developed methods (Ullah *et al.* 2015). The composite core@shell photocatalyst is expected to be active under both UV (direct activation) and visible light (indirect activation) illumination and show improved photocatalytic and antibacterial activity due to increased specific surface

area, better dispersion and higher thermal stability of the supported TiO₂ and efficient absorption/harvesting of light. The *IRLPC* will be prepared by coupling TiO₂ (and/or WO₃) with UC materials such as rare earth metal-based crystals (NaYF₄:Nd³⁺:Yb³⁺, Tm³⁺). The UV light emitted by the UC component upon absorption of NIR radiation can be used to excite TiO₂ coated as thin film on the surface UC particles. The photoactivity of the photocatalysts as function of composition and architecture as well as illumination mode (pulsed illumination/steady illumination) will be evaluated both in presence of UV-visible light (for VLPC) and NIR light (for IRLPC only) as illumination sources. Finally, the composite photocatalyst will be tested for disinfection of water in a homemade photo-reactor under optimized illumination conditions.

Project 2: Nanostructure materials and thin films based on TiO₂ for application in photocatalysis

PI's PhD Project 2010-2014, University of Sao Paulo. Supervisor: Professor Dr. Ubirajara Pereira Rodrigues-Filho, Supported by FAPESP Brazil, CNPq Brazil and TWAS-CNPq Italy-Brazil.

The aim of this project was to prepare and characterize TiO₂ and core@shell (SiO₂@TiO₂) nanoparticles (CSNs) and form layer-by-layer (LbL) films with these nanoparticles (NPs) on various substrates. *Firstly*, amorphous TiO₂ were prepared from oxotitanium (IV) sulfate (TiOSO₄) and crystallized by low-temperature *hydrothermal treatment (HTT)*. The effect of hydrothermal temperature and treatment time on crystallinity, particle size and photoactivity of TiO₂ was studied. The TEM, XRD and BET surface area analysis confirmed that HTT at temperature as low as 105°C can be used to obtain phase-pure anatase nanoparticles with good crystallinity (~95%), small crystallite size (<10 nm), high surface area (>200 m².g⁻¹) and excellent phase selectivity. *Secondly*, TiO₂ nanocatalyst was directly deposited, via sol-gel route, on the surface of Stöber silica NPs of around 200 nm in a *core@shell (SiO₂@TiO₂)* configuration to obtain better thermal stability, good dispersion and less agglomeration of the nanocatalyst. SEM and TEM observation confirmed the formation of a porous anatase shell of crystalline TiO₂ consisting of around 5–8 nm small crystallites, in accordance with XRD results. The shell thickness was varied between 10–30 nm by varying the quantity of precursor titanium (IV) isopropoxide (TiP). Compared to the uncoated silica, the BET surface area also increased by 147–365% depending on the amount of TiP added during synthesis step. The effect of shell morphology and TiO₂ loading on surface area and photoactivity has been studied and compared among different CSNs. *Finally*, a new and versatile LbL procedure for the preparation of porous and highly dispersed multilayer films of TiO₂ and phosphotungstic acid (HPW) on different substrates was developed using *Cellulose Phosphate (CP)* as an efficient and non-conventional binder. The films formation was monitored by UV/Vis spectroscopy and the interaction between the films components (CP, TiO₂ and HPW) was studied by HRTEM, XPS and FTIR techniques. These CP/TiO₂ and CP/TiO₂/HPW LbL films showed good photoactivity

against stearic acid (SA), crystal violet (CV) and methylene blue (MB) under UV irradiation. The CP/HPW films formed on bacterial cellulose showed good photochromic response, which is enhanced in presence of TiO_2 due to an interfacial electron transfer from TiO_2 to HPW. This simple and environmentally safe method can be used to form coatings on a variety of surfaces with photoactive TiO_2 and TiO_2 /HPW films.

Project 3: Nanostructured Films: Impact of architecture on photoactive properties of films containing nanoparticles and phosphotungstates (polyoxometalates)

This project, supported by Sao Paulo Research Foundation (FAPESP) was supervised by Prof. Dr. Ubirajara Pereira Rodrigues Filho at University of Sao Paulo, and I was part of the group working on the project.

This project aimed to understand the relationship between chemical composition-structure-morphology and photochemical reactivity of nanostructured thin films. The photoactive compounds studied were semiconducting oxides (TiO_2 and ZnO) and the polyoxometalate chosen was phosphotungstate. A second approach was to use shell@core TiO_2 @ SiO_2 nanoparticles as photoactive element, instead the TiO_2 or ZnO . This approach allowed us to tune the energy of the border level of the conduction band of the semiconductor by controlling the thickness of the TiO_2 shell. Such control is important for higher efficiency of reactive oxygen species (ROS) generation, such as hydroxyl radical, as well as result on higher photochromic activity. The photoactive compounds were dispersed in two different solid matrices: Ormosils and electrostatic Layer-by-Layer films. The multilayered films were prepared by dip coating using polyphosphates as polyelectrolytes. The photo-reactivity is going to be evaluated by recording the photochromic behavior and their photocatalytic activity for degradation of lipids and s-triazines. Their photocatalytic activity was evaluated by studying their photochromic activity and their photocatalytic activity towards methylene blue and crystal violet. These chemicals were chosen due to their recognized reactivity toward OH radicals generated by the photocatalytic species. Moreover, the ormosils photoreactivity was essayed toward crystal violet. New class II hybrid Materials with poly(dimethylsiloxane) and silicate interpenetrating network chemically bonded through urethane bond will be prepared aiming higher mechanical, chemical and photochemical stability as matrices to the photoactive materials, phosphotungstate and TiO_2 and ZnO .”