

Academic Profile

Personal Information:

Dr. QUAZI ARIF ISLAM
E-mail: arif.chem007@gmail.com
Nationality: Indian
Gender: Male

Present Position: Assistant Professor at Department of Chemistry, Alipurduar College

Previous Position:

- 06/11/2019 – 01/02/2020: Postdoctoral Fellow, Engineering Research Center of Nano-Geo Materials of Ministry of Education, Faculty of Materials Science and Chemistry, China University of Geosciences, Wuhan, China
- 02/03/2017 – 25/10/2019: Postdoctoral Fellow, Centre for Advanced Functional Materials (CAFM), Indian Institute of Science Education and Research (IISER) Kolkata, India

Education:

- Doctor of Philosophy (Ph.D) in Chemistry (2010-2016) from Fuel Cell and Battery Division, CSIR-Central Glass and Ceramic Research Institute (Degree Awarded by Jadavpur University), Kolkata, India.
Thesis: Development of mixed ionic and electronic conducting (MIEC) ceramic-based membranes for gas separation application; Supervisors: Dr. R.N. Basu and Dr. M.W. Raja.
- Master of Science (M.Sc) in Chemistry (Specilization: Inorganic Chemistry) (2008-2010) from Department of Chemistry, Burdwan University, West Bengal, India.
- Bachelor of Science (B.Sc) in Chemistry (2005-2008) from Department of Chemistry, Suri Vidyasagar College, Burdwan University, West Bengal, India.

Academic Years:

- 06/11/2019 to 01/02/2020: Postdoctoral Fellow, Engineering Research Center of Nano-Geo Materials of Ministry of Education, Faculty of Materials Science and Chemistry, China University of Geosciences, Wuhan, China
- 02/03/2017 to 25/10/2020: Postdoctoral Fellow, Centre for Advanced Functional Materials (CAFM), Advanced Functional Materials Laboratory (AFML), Indian Institute of Science Education and Research (IISER) Kolkata, India
- 16/11/2010 to 23/11/2016: PhD Research Scholar, Fuel Cell and Battery Division, CSIR-Central Glass and Ceramic Research Institute, Kolkata, India
- 01/08/2008 to 31/07/2010: Master of Science (M.Sc), Department of Chemistry, Burdwan University, West Bengal, India.
- 01/07/2005 to 01/06/2008: Bachelor of Science (B.Sc), Department of Chemistry, Suri Vidyasagar College, Burdwan University, West Bengal, India.

Research Interests:

- Perovskite oxides and nanomaterials for electrocatalytic water splitting, metal-air battery
- Development of nanostructured materials for low temperature solid oxide fuel cell (LT-SOFC)
- Development of novel compositions for hydrogen and oxygen separation membranes
- Exsolution of nanoparticles on metal oxides
- Development of 2D materials

Key Research Contributions:

- First to develop perovskite oxide nanorods from aquatic weed for dense ceramic oxygen separation membrane application
- Novel compositions development for gas separation membrane application
- Development of efficient trifunctional electrocatalyst based on perovskite exsolution
- Preparation of perovskite oxide 2D nanosheets by wet chemical route

Publications:

- 1) **Quazi Arif Islam**, Sourav Nag, Rajendra Nath Basu, Electrical properties of Tb-doped barium cerate, *Ceramics International* 39 (2013) 6433-6440.
- 2) **Quazi Arif Islam**, Sourav Nag, Rajendra Nath Basu, Study of electrical conductivity of Ca-substituted $\text{La}_2\text{Zr}_2\text{O}_7$, *Materials Research Bulletin* 48 (2013) 3103-3107.
- 3) **Quazi Arif Islam**, Mir Wasim Raja, Rajendra Nath Basu, Synthesis of $\text{BaBi}_{0.2}\text{Co}_{0.35}\text{Fe}_{0.45}\text{O}_{3-\delta}$ by a novel aqueous soft chemical method and its characterizations, *Journal of Alloys and Compounds* 583 (2014) 7-14.
- 4) **Quazi Arif Islam**, Mir Wasim Raja, Chiranjib Satra, Rajendra Nath Basu, Low temperature synthesis of nanocrystalline scandia stabilized zirconia by aqueous combustion method and its characterizations, *Bulletin of Materials Science* 38(6) (2015) 1473-1478.
- 5) **Quazi Arif Islam**, Mir Wasim Raja, Rajendra Nath Basu, Filter paper derived cross-linked interconnected $\text{BaBi}_{0.2}\text{Co}_{0.35}\text{Fe}_{0.45}\text{O}_{3-\delta}$ morphology with enhanced oxygen permeation property, *RSC Advances* 6 (2016) 882-890.
- 6) **Quazi Arif Islam**, Mir Wasim Raja, Rajendra Nath Basu, $\text{La}_x\text{Sr}_{1-x}\text{Co}_{0.35}\text{Bi}_{0.2}\text{Fe}_{0.45}\text{O}_{3-\delta}$ ($x = 0.5$ to 0.8): A new series of oxygen separation membrane, *International Journal of Hydrogen Energy* 41 (2016) 4682-4689.
- 7) **Quazi Arif Islam**, Sourav Nag, Rajendra Nath Basu, Chemical Stability and Electrical Conductivity of $\text{Ba}_{0.8}\text{Ce}_{0.85-x}\text{Zr}_x\text{Tb}_{0.15}\text{O}_{3-\delta}$ Proton Conductors with ZnO as Sintering Aid, *Transactions of the Indian Ceramic Society* 75 (2016) 1-8.
- 8) Debasish Das, **Quazi Arif Islam**, Rajendra Nath Basu, Electrophoretic Deposition Kinetics and Characterization of Ni-La_{1.95}Ca_{0.05}Zr₂O_{7- δ} Particulate Thin Films, *Journal of the American Ceramic Society* 99 (2016) 2937-2946.
- 9) Mir Wasim Raja, **Quazi Arif Islam**, Rajendra Nath Basu, Oxygen separation membrane derived from aquatic weed: A novel bio-inspired approach to synthesize $\text{BaBi}_{0.2}\text{Co}_{0.35}\text{Fe}_{0.45}\text{O}_{3-\delta}$ perovskite from Water Hyacinth (*Eichhornia Crassipes*), *Journal of Membrane Science* 522 (2017) 168-174.
- 10) **Quazi Arif Islam**, Mir Wasim Raja, Rajendra Nath Basu, Zr- and Tb-doped barium cerate-based cermet membrane for hydrogen separation application, *Journal of the American Ceramic Society* 100 (2017) 1360-1367.
- 11) **Quazi Arif Islam**, Rahul Majee, Sayan Bhattacharyya, Bimetallic Nanoparticle Decorated Perovskite Oxide for State-of-the-art Trifunctional Electrocatalysis, *Journal of Materials Chemistry A* 7 (2019) 19453-19464.
- 12) Rahul Majee, **Quazi Arif Islam**, Sayan Bhattacharyya, Surface Charge Modulation of Perovskite Oxide at the Crystalline Junction with Layered Double Hydroxide for Durable Rechargeable Zinc-air Battery, *ACS Applied Materials & Interfaces* 11 (2019) 35853-35862.
- 13) Rahul Majee[‡], **Quazi Arif Islam**[‡], Surajit Mondal, Sayan Bhattacharyya, An electrochemically reversible lattice with redox active A-sites of double perovskite oxide nanosheets to reinforce oxygen electrocatalysis, *Chemical Science* 11 (2020) 10180-10189.
- 14) Xin Chen, Bao Dong, **Quazi Arif Islam**, Huaibing Song, Yan Wu, Semiconductor-ionic properties and device performance of heterogeneous La-doped CeO_2 -ZnO nanocomposites, *International Journal of Hydrogen Energy* (<https://doi.org/10.1016/j.ijhydene.2020.04.174>)

15) Surajit Mondal, Rahul Majee, **Quazi Arif Islam**, Sayan Bhattacharyya, 2D Heterojunction Between Double Perovskite Oxide Nanosheet and Layered Double Hydroxide to Promote Rechargeable Zinc-Air Battery Performance, ChemElectroChem (<https://doi.org/10.1002/celec.202001412>)

Fellowship and Awards:

- **2012: Best Poster Paper Award** for the paper entitled “*Tb-doped Barium Cerate: A High Temperature Proton Conductor for Dense Ceramic Membrane*” in International workshop on Recent Advancement in Membranes for Liquid & Gas Filtration held at CGCRI, Kolkata
- **2014: CSIR** (Council of Scientific & Industrial Research) **Senior Research Fellowship** in 2014
- **2014: Best Oral Paper Award** for the paper entitled “*Ca-doped Lanthanum Zirconate: A Hydrogen Separation Membrane*” in 3rd Annual Workshop, Research Scholars’ Day held at CGCRI, Kolkata
- **2015: Best Oral Paper Award** for the paper entitled “*Cross-linked Interconnected Powder Morphology Obtained by Filter Paper Templating Method for Application as Oxygen Separation Ceramic Membrane*” in Indian Innovations in Materials Research: New Materials and Processes (IIMR-15) held at CGCRI, Kolkata
- **2016: MRSI Young Scientist-2016 Award** for the paper entitled “*Synthesis of nanorods from bio-waste Eichhornia Crassipes: A novel approach to develop oxygen separation membrane*” at the Young Scientists’ Colloquium 2016, Materials Research Society of India (MRSI), Kolkata Chapter held at S. N. Bose National Centre for Basic Sciences, Kolkata
- **2017: SERB-National Postdoctoral Fellowship**, Department of Science & Technology, Government of India

Funding:

Received project funding for my SERB-National Postdoctoral Fellowship. Acted as the project investigator (PI) of the project. Total Funding amount is ~ US\$28000.

Selected Conferences:

- 1) POSTER, India-EU 3rd EICOON School on Nano materials, Kolkata, India, May 3-4, 2012
- 2) POSTER, International workshop on Recent Advancement in Membranes for Liquid & Gas Filtration, Kolkata, India, December 27, 2012
- 3) POSTER, 100th Science Congress, Kolkata, India, January 3-7, 2013
- 4) ORAL, 77th Annual Session of the Indian Ceramic Society, Jamshedpur, India, December 19-20, 2013
- 5) ORAL, Young Scientists’ Colloquium–2016 (YSC 2016), Materials Research Society of India (MRSI), Kolkata Chapter, Kolkata, India, September 16, 2016

Short Description of PhD and Postdoc Work:

My PhD work aims to develop novel mixed ionic and electronic conducting (MIEC) based dense ceramic membranes for their potential application in hydrogen and oxygen gas separation technology. For this purpose, BaCeO₃ and BaCoO₃ (ABO₃ type) based perovskite materials have been selected as primary frame works, where variety of dopants are introduced both in its A and B-sites to study their effects in membrane performance in terms of hydrogen and oxygen separation respectively. A large number of doped and co-doped materials have been synthesized and characterized in detail and their permeation performance has been examined using in-house fabricated permeation measurement set up.

For hydrogen separation membrane development, calcium doped La₂Zr₂O₇ pyrochlore and Tb, Zr doped BaCeO₃ perovskite systems have been explored and characterized in detail. To introduce electronic contribution, nickel has been mixed with the optimized proton conductors and finally, their hydrogen permeation flux is studied.

For oxygen separation membrane development, La and Sr doped novel type $\text{La}_x\text{Sr}_{1-x}\text{Fe}_{0.45}\text{Co}_{0.35}\text{Bi}_{0.2}\text{O}_{3-\delta}$ ($x = 0.5$ to 0.8) compositions, $\text{BaM}_{0.2}\text{Co}_{0.35}\text{Fe}_{0.45}\text{O}_{3-\delta}$ ($M = \text{Nb}/\text{Sc}/\text{Ta}$) perovskites have been developed. The developed membranes remain stable during 120 h of continuous operation at 900°C under the air/Ar gradient. Steady oxygen permeation flux of the membranes for more than 50 h of operation in presence of carbon dioxide as the sweep gas reflects improved chemical stability of the developed membranes.

In another approach, different synthesis methodologies namely, alanine assisted combustion methods, filter paper templating method and bio-inspired synthesis process have also been explored in the present thesis to engineer the microstructure of $\text{BaBi}_{0.2}\text{Co}_{0.35}\text{Fe}_{0.45}\text{O}_{3-\delta}$ (BBCF) perovskite oxide and to study their effect in physico-chemical properties.

Apart from my thesis topic, during my Ph.D., I also worked on the synthesis of electrolyte (Eleven mol% scandia-stabilized zirconia), and anode material ($\text{Ni-Ce}_{0.75}\text{Zr}_{0.25}\text{O}_{2-\delta}$) for solid oxide fuel cell application, ceramic separator (SiO_2 , ZrO_2 loaded filter paper) for Li-ion battery.

Over the last three years, I have been working as postdoc on a number of projects related to electrolyte materials for low-temperature solid oxide fuel cell application, oxygen reduction reaction, electrocatalytic water splitting, and Zn-air battery. For this purpose, $\text{SrNb}_{0.1}\text{Co}_{0.9-x}\text{Ni}_x\text{O}_{3-\delta}$ perovskite with Co-Ni alloy nanoparticles on the surface, $\text{BaCo}_{0.5}\text{Fe}_{0.3}\text{Ta}_{0.2}\text{O}_{3-\delta}$ perovskite with Co_xP_y , Co_xS_y on the surface, NiFe sheet on $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{Co}_{0.8}\text{Fe}_{0.2}\text{O}_{3-\delta}$, $\text{PrBaCo}_{2-x}\text{Mn}_x\text{O}_{6-\delta}$ double perovskite nanosheets have been synthesized and characterized in detail. My research experience in the present lab includes both the management of the independent project as well as substantial work as a member of a team (including in collaboration with Ph.D. students of the group).

Expertise and training:

Development of nanostructured materials for versatile applications including-

- Hydrogen and oxygen separation membrane
- Electrocatalytic water splitting
- Solid oxide fuel cell
- Zn-air battery

Skills and techniques:

- Synthesis of functional materials in large volume by solid state and combustion method
- Structural engineering of nanostructured materials
- Development of novel synthesis processes
- Material characterizations- Physical and electrochemical
- Development of in-house gas permeation set-up
- Instruments handled: X-ray diffractometer, gas chromatography, dilatometer, thermo gravimetric analyser, table top scanning electron microscope, fourier-transform infrared spectrometer, ultraviolet-visible spectrometer, 4-probe conductivity measurement set-up, Impedance spectroscopy, Potentiostat, surface area analyser, scan coater

Others:

- Membership in Indian Science Congress during 2012-2013
- Membership in Indian Ceramic Society during 2013-2014
- Language Known: English (writing and speaking), Bengali (mother tongue), Hindi (speaking)
- ResearchGate link: https://www.researchgate.net/profile/Quazi_Islam
- Google scholar link: https://scholar.google.com/citations?hl=en&user=Lhvgx3oAAAAJ&view_op=list_works&sortby=pubdate