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Dr. Firoz Khan

Research Scientist/ Associate Professor

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King Fahd University of Petroleum & Minerals, Saudi Arabia

Executive Summary

Research Scientist with more than 15 years of R&D experience in Photovoltaic (PV), Nanomaterials, Graphene, Quantum Dots, and Energy Storage Devices. Has strong background in:

- ✓ **Silicon PV:** Work on fabrication and characterization of the silicon PV cells/modules. Degradation study of PVs, Building integrated PVs (BIPVs), and Solar Roads. Solar cell physics.
- ✓ **Perovskite PV:** R&D perovskite solar cells. Development of the metal oxide-based electron and hole transport layers. Perovskite passivation using polymers.
- ✓ **Nanomaterials:** Synthesis and characterization of the nanomaterials, such as metal hydroxide, metal oxide, layered double hydroxide, graphene, graphene quantum dots, etc.
- ✓ **Supercapacitors & Batteries:** Work on energy storage devices. Fabrication of solar cells and energy storage hybrid devices. Development of electrode materials and polymer-based solid electrolytes.

Education

- ☐ PhD Physics (CSIR-NPL/JMI, India, 2012)
- ☐ MSc Physics, Electronics (AVADH Uni, 2002)
- ☐ BSc Physics, Chemistry, Mathematics

Distinguished Projects

- Effect of High Outdoor Temperature on the PV modules with Advance Internal Architecture (*Project No INRE2107, 2021-2023, IRC, King Fahd University of Petroleum and Minerals, Saudi Arabia*).
- Mono-(Cu, N) and Co-(Cu-N) Doped Metal Oxide: A Smart UV-Protective Layer for Photoactive Devices (*Project No INRE2114, 2021-2023, IRC, KFUPM, KSA*).
- Enhancing the stability of the perovskite solar cells via polymer passivation for building applications (*Project No INRE2109, 2021-2023, IRC, KFUPM, KSA*).
- Novel double layer atmospheric pressure chemical vapor deposition method for all inorganic perovskite synthesis: Development of PV technology stable against harsh weather conditions (*Project No. DF191048, 2020-2023, DSR, KFUPM, KSA*).
- Synthesis of hierarchical porous and hollow MgO microspheres for solar energy storage, (*Project No. DF191056, 2020-2023, DSR, KFUPM, KSA*).
- Limitations and applicability of the analytical methods to extract the cell parameters of PV systems: A critical review (*Project No. RDO-HQIP19_22, 2019~2020, RDO-MOE, KSA*).
- Novel Graphene Wrapped Ni-Co Layered Double Hydroxides Electrode for High Performance Hybrid Supercapacitors, (*Project No. SR181030, 2019~2020, DSR, KFUPM, KSA*).
- Quantum Alchemy Design New framework material engineering and multiple analysis technology, the Daegu Gyeongbuk Institute of Science & Technology (DGIST) R&D Program (*Grant No. NRF-2018M3D1A1058728, 2018~2020*) funded by the Ministry of Science, ICT and Future Planning, South Korea).
- Development of smart textile convergence technology (*Project No. 2017010022, (17-NT-02) 2017~2019, The Ministry of Education, Science and Technology, South Korea*).
- Development of 20% efficiency thin film solar cell using nano-pattern back electrode and solution process based on ultra-thin CIGS below 1 micrometer (*Grant No. 20163010012570, 2016-2020, The Ministry of Education, Science and Technology, South Korea*).
- Development of road-integrated module using high performance 16% C-Si module and high durability, high functional 12% flexible CIGS thin film solar module (*Project No. 2017050028, (Grant No. 20173010012880) 2017-2019, The Ministry of Education, Science and Technology, South Korea*).
- Perovskite and silicon tandem solar cell with improved performance and air stability (*Project No. 2017020025, (Grant No. NRF-2012-0001264) 2017~2018, Tunisia-Korea joint international project*) Ministry of Education, Science and Technology, South Korea.
- Novel graphene-based electrode materials for energy storage devices, the Energy Technology Development Program of the Korea Institute of Energy Technology Evaluation and Planning (*Project No. 2016120014, 2016~2018, South Korea*).
- Development of novel materials for Li-ion batteries by the DGIST R&D Program (*Grant No. 17-NT-02, 2017~2018*) funded by the Ministry of Science, ICT and Future Planning, Republic of Korea.
- Development of materials for energy storage devices, DGIST R&D Program (*Grant No. 15-EN-01, 2015 ~ 2016*) funded by the Ministry of Science, ICT and Future Planning of the Korean Government, South Korea).
- The development of electrode material for high-capacity Li-ion capacitor for EES application (*Project No. 14-EN-01, 2014 ~ 2016, The Ministry of Education, Science and Technology, South Korea*).
- Development of high efficiency Si solar cell (with LG electronics), (*2012~2015*) Ministry of Knowledge and Economy, South Korea.
- Development of 3-dimensional large area nano plasmonic platform for next generation optoelectronic device (*Grant No. 12-HRS-05, DGIST HRHR R&D Program, 2012/05/01~2013/12/31*) Ministry of Education, Science and Technology, South Korea.
- Development of cathode materials for high performance secondary batteries (*Project No. 11-EN-03, 2011-2014, The Ministry of Education, Science and Technology, South Korea*).
- Development of Low-Cost CIGS Solar Cells with Power Conversion Efficiency of 10 % (*Project No. 2011-0001649, 2011-2014, Ministry of Science, ICT and Future Planning, MSIP, South Korea*).
- Development of high efficiency large area silicon solar (*Project No. SIP-17, 2008 ~ 2011, Ministry of Science and Technology, India*).

Research Summary

- Number of Published Papers 48
- Citations 977
- H-Index 17
- Number of Patents 11
- Books etc. 01

Award and Recognitions

DGIST 10 Years Achievement Award for best scientist on 11th anniversary (Award No: 15-128, Dated September 04, 2015)



GATE (IITs): 2004, 2005, 2006

CSIR-UGC National Eligibility Test (NET)

Junior Research Fellowship (JRF) qualified in June 2005 under Council of Scientific and Industrial Research, CSIR; India

Junior Research Fellowship (JRF) qualified in December 2005 under University Grants Commission, UGC; India

Skills and Expertise

- Theoretical and Experimental research on photovoltaic. Development of silicon-based PVs, including various structures. PV degradation study and lifetime estimation, and cost calculation.
- Development of the nanomaterials for enhancing the power conversion efficiency and lifetime of CIGS and silicon-based PVs.
- Development of perovskite materials for new generation PV cells.
- Utilization of polymer for improving the performance and stability of the perovskite PV cells.
- Development of the polymer-based solid-state electrolyte for all-solid-state Li-metal batteries.