

Curriculum Vitae

Dr. Arbab Mohammad Toufiq

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Educational and Research Background

Visiting Researcher (March 2016-June 2016)

UNAM-National Nanotechnology Research Center, Institute of Materials Science and Nanotechnology, Bilkent University, Ankara, Turkey

Postdoctoral Associate (2015-2016)

European Research Council (ERC) and Science and Technological Research Council of Turkey (TUBITAK) Funded Projects “**Novel Fibers for Acoustics and Fiber Laser Applications**” and “**Fabrication Scheme in Nanotechnology**”

UNAM-National Nanotechnology Research Center, Institute of Materials Science and Nanotechnology, Bilkent University, Ankara, Turkey

PhD Gold Medalist (Experimental Condensed Matter Physics) 2011-2014

School of Mathematics and Physics, Department of Physics, **University of Science and Technology Beijing, P. R. China** (2011-2014)

Masters in Physics, Department of Physics, University of Peshawar, Pakistan

BSc (Physical Sciences), Islamia College Peshawar, University of Peshawar, Pakistan

FSc (Pre-Engineering), Islamia College Peshawar, University of Peshawar, Pakistan

Assistant Professor, Department of Physics, Hazara University Mansehra, Pakistan (Nov 01, 2018-present)

Lecturer, Department of Physics, Hazara University Mansehra, Pakistan (May 2007-Oct 2018)

Aims and Objectives of PhD Research

Fabrication of Group IV based advanced functional oxides novel nanostructures by a facile hydrothermal method.

Study their components and structural investigations by employing Scanning electron microscope, Transmission electron microscope, High-resolution transmission electron microscope, X-ray photoelectron spectroscopy, X-ray diffraction and Raman Spectroscopy.

Investigate the optical properties of the obtained advanced functional nanomaterials by probing their photoluminescence emissions and Ultraviolet-visible absorption behavior, Optical band gap values and their mechanism.

Study the magnetic properties employing vibrating sample magnetometer (VSM) and discuss their mechanism.

Analysis of the possible future applications of the synthesized nanostructures in solar cells, Ultraviolet and visible light emission devices and magnetic resonance imaging

Research Mission of the PhD Project

The main focus of the research has been to explore the recent advances on single-crystalline manganese-based functional oxides nanostructures with an emphasis on systematic variations in the electronic and crystal structure, their comparative analysis to study the correlation of structural investigations with the observed optical and magnetic properties in detail. The controlled-synthesis of manganese-based functional oxides novel nanostructures including 1D MnO_2 Nanorods, Nanowires, Shrimps-like nanostructures, 3D Mn_3O_4 Nanocoins, 3D $\text{Cu}_{0.45}\text{Mn}_{0.55}\text{O}_2$ Nanowhiskers, Flower-like Nanostructures and Nanoflowers has been achieved by the choice of hydrothermal synthetic strategy. Furthermore, the effect of reaction parameters, choices of precursors, pH values, variation in the hydrothermal reaction time and temperature and doping materials on the diameter and structural aspects, growth parameters, lattice vibrations and opto-magnetic properties of the obtained nanostructures has been investigated by several characterization tools and discussed in detail to explore the origin and mechanisms responsible for their remarkable physical properties.

Research Accomplishments

The following main achievements have been obtained during my PhD research work by the efficient utilization of hydrothermal-growth strategy of MnO_2 , Mn_3O_4 and $\text{Cu}_{0.45}\text{Mn}_{0.55}\text{O}_2$ nanostructures with controlled morphology, dimension and orientation to achieve the desired physical properties for many potential applications.

Several novelties for various nanostructured 1D single-crystalline MnO_2 architectures such as improvement in the crystalline structure and surface morphology by introducing SiO_2 as

a dopant, diameter-controlled synthesis by varying the hydrothermal reaction time, novel size-dependent magnetic properties with weak ferromagnetic characteristics, novel photoluminescence emissions in green-violet spectral region, maximum UV-visible absorption in the visible region and a wide band gap value of 2.5 eV has been studied in detail.

I have successfully reported the hydrothermal-growth of novel 3D Mn_3O_4 coins-like nanostructures self-assembled with randomly distributed single-crystalline nanoparticles. The novel photoluminescent spectra of the as-prepared Mn_3O_4 nanostructures exhibit prominent emission bands located in ultraviolet, violet, blue and green spectral regions without altering the surface chemistry of the material. In addition, a novel yellow PL emission peak has been observed and attributed to the d-d transitions involving Mn^{3+} ions in self-assembled randomly oriented nanoparticles. The observed highly photoluminescent response in the yellow –ultraviolet has been achieved without any surface modification.

Controlled synthesis of various 3D $\text{Cu}_{0.45}\text{Mn}_{0.55}\text{O}_2$ novel nanostructures including nanowhiskers self-assembled by interconnecting single-crystalline nanosheets, flowerlike nanostructures and nanoflowers self-assembled by interconnecting densely stacked single-crystalline nanoplates by a facile hydrothermal-growth strategy. The structural features are studied to analyze the near-neighbor environment of oxygen coordination around manganese and copper cations and reported for the first time using Raman scattering spectroscopy. Furthermore, the thermodynamic phase stability, novel PL emission spectra in the red-violet spectral region, maximum UV-visible absorption in the visible region, wide band gap value of 2.53 eV and novel weak ferromagnetic properties have been reported during my PhD studies.

Objectives and Accomplishments of Postdoctoral Research

I have made significant contributions to the project by developing a **cutting-edge novel fabrication scheme in combination with MCVD method** for “Rare-earth doped Alumino-Silicate Nanoparticles” which is the first of its kind and considered as a major breakthrough in the field. The proposed fabrication scheme is sufficiently versatile and can be adapted to incorporate RE elements and co-dopants with excellent dopant uniformity and good repeatability.

My Postdoctoral Research is based on ERC and TUBITAK funded project “Novel Fibers for Acoustics and Fiber Laser Applications” in a well-known National Center and top world ranked University. The main responsibilities during my Postdoctoral research included Fabrication of “Rare-earth doped Alumino-Silicate Nanoparticles” for Preform growth using state-of-the-art Modified Chemical Vapor Deposition (MCVD) technique to produce High Power Fiber Lasers and their detailed analysis using advanced characterization tools such as WDS, TEM, SEM, EDX XPS, and Raman etc. Our focal research in the project has been to grow high quality preforms to gain high output power and high efficiency with low power

losses in the drawn fiber. The primary focus of my Postdoctoral research is to develop a novel and an effective fabrication method for Rare-earth doped Silica nanostructures which can be combined with MCVD to obtain the best results to be reported for benefits of science community.

Total Number of International Peer reviewed Publications = 30

Science Citation Indexed (SCI) / W Category Publications = 26 (Web of Science / JCR)

Engineering Indexed (EI) Publications = 04 (EI Village)

Total Impact Factor = 42 (Thomson Reuters, Web of Science / JCR)

Number of Citations = 224 (Thomson Reuters, Web of Science)

MS Research Students supervised as a PI = 05

Ongoing Supervision of MS research students as PI = 07

Ongoing Supervision of PhD Research student as PI = 01

(List of Publications)

1- Arbab Mohammad Toufiq, Fengping Wang, Qurat-ul-ain Javed and Yan Li “*Influence of SiO₂ on the Structure-Controlled Synthesis and Magnetic Properties of Prismatic MnO₂ Nanorods*” **Nanotechnology** Volume 24 (41) 2013, 415703

2- Arbab Mohammad Toufiq, Fengping Wang, Qurat-ul-ain Javed, Quanshui Li and Yan Li “*Hydrothermal Synthesis of MnO₂ Nanowires: Structural Characterizations, Optical and Magnetic Properties*” **Applied Physics A** Volume 116 (2014), 1127-1132

3- Arbab Mohammad Toufiq, Fengping Wang, Qurat-ul-ain Javed, Quanshui Li and Yan Li “*Hydrothermal Synthesis of Cu_{0.45}Mn_{0.55}O₂ Nanowhiskers: Structural Characterizations and Optical Properties*” **Materials Letters** Volume 118 (2014), 34-38

4- Arbab Mohammad Toufiq, Fengping Wang and Qurat-ul-ain Javed “*Synthesis, Characterization and Optical Property of Shrimps-like Nanostructures of MnO₂ by Hydrothermal Route*” **J of Nanosci. Nanotech** Volume 13, 2948-2952, 2013

5- Arbab Mohammad Toufiq, Fengping Wang, Qurat-ul-ain Javed, Quanshui Li and Yan Li “*Hydrothermal Synthesis of 3D Cu_{0.45}Mn_{0.55}O₂ Nanostructures: Lattice Vibrations and Novel Photoluminescence Properties*” **Applied Physics A** Volume 115, 2014, 1133-1137

6- Arbab Mohammad Toufiq, Fengping Wang, Qurat-ul-ain Javed, Quanshui Li, Yan Li and Matiullah Khan “*Synthesis, Characterization and Photoluminescent Properties of 3D Nanostructures self-assembled with Mn₃O₄ Nanoparticles*” **Materials Express** 4, 2014, 258-262

7- Arbab Mohammad Toufiq, Fengping Wang, Qurat-ul-ain Javed, Quanshui Li and Yan Li “*Synthesis and Characterization of 3D Cu_{0.45}Mn_{0.55}O₂ Nanoflowers with Novel Photoluminescence and Magnetic Properties*” **Mod Phy Lett B** Volume 28 (9) 2014, 1450071

8- Arbab Mohammad Toufiq, Fengping Wang, Qurat-ul-ain Javed and Yan Li “*Magnetic Properties of MnO₂ Shrimps-like Nanostructures Synthesized by Hydrothermal Route*”

Mod Phy Lett B Volume 27 (29) 2013, 1350215

9- Arbab Mohammad Toufiq, Fengping Wang, Qurat-ul-ain Javed and Yan Li “*Effect of hydrothermal dwell time on the diameter controlled-synthesis and magnetic properties of MnO₂ Nanorods*” **Mod Phy Lett B** Volume 28 (6) 2014, 1450045

10- Arbab Mohammad Toufiq, Fengping Wang, Qurat-ul-ain Javed, Quanshui Li and Yan Li “*Photoluminescence Spectra and Magnetic Properties of Hydrothermally synthesized MnO₂ Nanorods*” **Mod Phy Lett B** Volume 27 (29) 2013, 1350211

11- Qurat-ul-ain Javed, Fengping Wang, M Yasir Rafique, **Arbab Mohammad Toufiq**, Quanshui Li, Hassan Mahmood and Waheed Khan “*Diameter-controlled Synthesis of α -Mn₂O₃ Nanorods and Nanowires with enhanced Surface Morphology and Optical Properties*” **Nanotechnology** 23 (2012) 415603

12- Qurat-ul-ain Javed, Fengping Wang, **Arbab Mohammad Toufiq**, M Yasir Rafique, Hassan Mahmood “*Conspicuous reversible phase transformation of novel Cu_{1.4}Mn_{1.6}O₄ square nanosheets synthesized by auto-thermal process exhibiting intriguing optical and magnetic properties*” **Materials Letters** 99 (2013) 134-137

13- Qurat-ul-ain Javed, Fengping Wang, M Yasir Rafique, **Arbab Mohammad Toufiq** and M. Zubair Iqbal “*Canted antiferromagnetic and optical properties of nanostructures of Mn₂O₃ prepared by hydrothermal synthesis*” **Chinese Physics B** 21 (11), 2012, 117311

14- Qurat-ul-ain Javed, Fengping Wang, **Arbab Mohammad Toufiq**, M Yasir Rafique, M. Zubair, Kamran M. Arshad “*Preparation, Characterizations and optical property of single crystalline ZnMn₂O₄ Nanoflowers via template free hydrothermal synthesis*” **J of Nanosci. Nanotech.** 13 (4) 2013 2937-2942

15- Qurat-ul-ain Javed, Fengping Wang, **Arbab Mohammad Toufiq** “*Controlled synthesis, characterizations and structural properties of micro-flowers, pine-cone, core-shell and liver-like micro-architecture of crystalline ZnMn₂O₄*” **J of Nanosci. Nanotech.** 13 (4) 2013, 2892-2896

16- Qurat-ul-ain Javed, Fengping Wang, **Arbab Mohammad Toufiq**, Mahmood Hasan, M Yasir Rafique, Waheed Khan, Quanshui Li “*Effect of atomic percentage of Zn on the size and optical properties of porous ZnMn₂O₄ Nanoparticles*” **J of Nanosci. Nanotech.** 13 (4) 2013 2917-2921

17- Matiullah Khan, Wenbin Cao, Ning Chen, Zahid Usman, Dil Faraz Khan, **Arbab Mohammad Toufiq**, Murad Ali Khaskheli “*Influence of Tungsten doping concentration on the electronic and optical properties of anatase TiO₂*” **Current Applied Physics** 13 (7) 2013 1376-1382

18- Ziya Wang, Fengping Wang, Yongkui Cui, Xingyang Li, **Arbab Mohammad Toufiq**, Yanzhen Lu, Quanshui Li “*Novel Method to Enhance the Visible emission of ZnO Nanostructures*” **Chemical Physics Letters** Volume 614, 2014, 53-56.

19- M. Zubair Iqbal, Fengping Wang, M. Yasir Rafique, Rafi Ud Din, Faheem K. Butt, Shujaat Ali, M. Ammar Khan, Qurat-ul-ain Javed, **Arbab Toufiq** “*Fabrication, Characterization and*

Hydrogen Sorption Properties of Stannous Oxide Nano-Flowers **Science of Advanced Materials** Volume 5, 2013, 758-763.

20- Q Javed, FP Wang, **Arbab Mohammad Toufiq**, M Yasir Rafique, M Zubair Iqbal, H Mahmood '*Spinel Oxide ZnMn₂O₄ Nanorods: Synthesis, Characterization and Optical Properties*' **Adv. Sci. Eng. Med.** 5(2) 166-172, 2013

21- Q Javed, FP Wang, Hasan Mahmood, M Yasir Rafique, **Arbab Mohammad Toufiq**, M Zubair Iqbal, Pengbo Yang '*Fabrication of Novel Sea-Urchin Cluster Assembled with Pen Type Nanoneedles of Hetaerolite ZnMn₂O₄ by Template-Free Hydrothermal Route*' **Adv. Sci. Eng. Med.** 4(5) 388-393, 2012

22- Yongkui Cui, Fengping Wang, M Zubair Iqbal, Yan Li, **Arbab Mohammad Toufiq**, Ziya Wang, Zhiyuan Wang, Shujaat Ali '*Synthesis of nanoflakes-based self-assembling crossed structure of stannous oxide and photocatalysis property*' **Crystal Research and Technology** Volume 50, 210-214, 2015

23- Qurat-ul-ain Javed, Hussain Abbas, Hasan Mahmood, A. Sattar, Fengping Wang, M. Arshad Kamran, M. Yasir Rafique, **Arbab Mohammad Toufiq** '*Morphology-Controlled Synthesis of Single Crystalline α -Mn₂O₃ Sea-Urchins Assembled with Pen-Type Nanoneedles and Broad Absorption Spectrum*' **J Nano Research** Volume 33, 38-48, 2015.

24- Hidayat Ullah Shah, Fengping Wang, **Arbab Mohammad Toufiq**, Abdul Muqsit Khattak, Azhar Iqbal, Zahid Ali Ghazi, Shujaat Ali, Xingyang Li, Ziya Wang '*Electrochemical Properties of Single-Crystalline Mn₃O₄ Nanostructures and their Capacitive Performance in Basic Electrolyte*' **Int. J. Electrochem. Sci.** Volume 11, 8155-8162, 2016

25- Hidayat Ullah Shah, Fengping Wang, **Arbab Mohammad Toufiq**, Shujaat Ali, Zia Ul Haq Khan, Yan Li, Jianling Hu and Kang He '*Electrochemical Properties of Controlled Size Mn₃O₄ Nanoparticles for supercapacitor Applications*' **J Nanosci. Nanotech** 18, 719-724, 2018

26- **Arbab Mohammad Toufiq**, Fengping Wang, Hidayat Ullah Shah, '*Synthesis and Characterization of MnO₂ Nanowires: Lattice vibrations and Photoluminescence properties*' **Physica Status Solidi c**, Volume 14, 2017, 1700176

27- Shujaat Ali, Fengping Wang, M. Zubair Iqbal, Saba Zafar, Hidayat Ullah Shah, **Arbab Mohammad Toufiq**, '*Hydrothermal Synthesis of Chalcogenide SnS Nanorods: Lattice Vibrations and Optical Properties*' **Chalcogenide Letters**, Volume 14, No. 12, 2017, 539-543

28- Najmul Hassan, Junaid Riaz, M Tauseef Qureshi, Aamir Razaq, M Raheem, **Arbab Mohammad Toufiq**, Abdul Shakoor, '*Vanadium Oxide (V₂O₃) for Energy Storage Applications through Hydrothermal Route*' **J Materials Science: Materials in Electronics** Volume 29, No. 18, 2018, 16021-16026

29- A Akyuz, O Inan, A Gungor, **Arbab Mohammad Toufiq** '*The Simulation of Shockwave lithotripsy*' **AIP Conf. Proc.**, Turkish Physical Society 34th International Physics Congress (TPS34) Volume 2042, No. 1, 2018, 020054

30- Amjad Khan, **Arbab Mohammad Toufiq**, Fawad Tariq, Yaqoob Khan, Rafaqat Hussain, Naureen Akhtar, Shams ur Rahman '*Influence of Fe doping on the Structural, Optical and Thermal Properties of α -MnO₂ Nanowires*' **Materials Research Express**, February 2019, Accepted Manuscript in press DOI: <https://doi.org/10.1088/2053-1591/ab0aaf>

Awards and Achievements

Participated as a Young Scientist in 65th Interdisciplinary Lindau Nobel Laureates Meeting in Lindau, Germany, 2015

President's Gold Medal 2014 for outstanding research contributions during Doctor's degree programme to the University of Science and Technology Beijing, P. R. China

The best PhD Thesis among the 2014 graduates in University of Science and Technology Beijing, P. R. China

Keynote Speaker / Invited Talk in International Conference on Nanocomposites and Multifunctional Materials 2017 held at National University of Sciences and Technology NUST, Islamabad, Pakistan (August 21-23, 2017)

Invited Speaker at the European Materials Research Society E-MRS Spring Meeting 2017, Strasbourg, France (May 22-26, 2017)

Award of Outstanding Contributions to International Student Education for the 2012-2013 academic year during my PhD studies

Second Prize in USTB's Excellent International Student Scholarship for the 2012-2013 academic year during my PhD studies

Vice President of International Students Union i.e. NSSU (New generation students study abroad union) appointed by the International Office University of Science and Technology Beijing, P. R. China (2012-2014)

Masters training in Physics organized by HEC (Higher education Commission) of Pakistan held at Quaid-i-Azam University, Islamabad Pakistan from 16th July to 15th August 2007.

Member Senate, Hazara University Mansehra, Pakistan (2009-2012)

Life membership of Pakistan institute of Physics

HEC PhD Approved Supervisor (2017-2020)

Letter of Appreciation from Vice Chancellor and Dean of Sciences Hazara University Mansehra in recognition of the outstanding performance and research professionalism during PhD studies (President's Gold Medal 2014)

REFERENCES

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