Eslam Sheha
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Eslam received his PhD from Benha University in 2007. Eslam holds Professor in the Physics Department at Benha University since 22/5/2017. The overall research goal aims to mitigate climate change by developing next-generation magnesium ion batteries with low cost, high capacity and safe compared with current lithium batteries. This research theme will help directly in the electrification of transportation and publicity of electric vehicles and zero carbon policy. Research specifications include elucidating the mechanisms that govern ion transport and applying such an understanding to developing advanced solid electrolytes and functional nano and micro-scale materials for advanced batteries for the grid's large-scale storage energy storage. He aims to establish a new class of magnesium cells based on non-traditional materials and demonstrated record power densities for these cells. His recent and future work on electrolyte and cathode for magnesium batteries will create new avenues to meet energy demands. Characterization tools range from A.C. impedance spectroscopy in various configurations to x-ray, electrochemical and thermal analysis. Eslam is the author and co-author of more than 55 peer-reviewed journal articles and one book chapter.

Research Vision

The current research aims to develop a new combination of sulfur and magnesium for a multivalent rechargeable ion battery. Motivation and the bigger picture here is to investigate the beyond lithium-ion technology with the usage of the earth abundant chemical elements that can potentially lower the cost of the battery package. The promising MgS full cell owns an attractive high prospective energy density of 3200 Wh l-The development of the innovative material compositions of the multivalent electrolyte, cathodes, and engineering their structural properties with optimal synthesis techniques guarantee realizing the commercial MgS battery.

Research Mission

The advantages of the MgS batteries lie in the high availability of magnesium and sulfur in nature and in their safety. The implications of the innovative aspect are huge: it will help the Egypt community build its **zero-emission policy**, resulting in a sustainable, green energy source to meet the high energy demands, **protect the planet** and **maintain health-based air quality standards**. In addition, research collaboration between junior faculty members will intellectually benefit education and trainings for the next generation scientists.

Education and Training

Professor	Physics Department, Faculty of Science Benha University	2017–present
Ph.D.	Energy Storage	2007
M.S.c	Material Science	2004
B.S	Physics	1999

Mentoring and Advising

I. **The academic supervisor** of the student delegation from Benha University to Wuhan University, China from 16/7/2019 to 7/8/2019

II. **Graduate students (Ph.D students: 3)**:, Mr. Nasser Yacout, Miss Rania Gamal, Miss Sara Youssif, Miss Sherein Noeuir

III. **Previous graduate students** (Ms.C: 6): Dr. Tarek Salah, Dr. Shimaa Elkalashy, Dr. Medhat Messalam, Dr. Nasser Yacuut, Dr. Rania Gamal Mr. Mostafa Mourad, Miss Rania Gamal, Miss Ola Elkalashy, Miss Mona Abd-Elmgid, Miss Nehal Walley

Synergistic Activities

IV. **Regular reviewer** for Energy Storage Materials, ACS Applied Energy Materials, Journal of alloys and compounds, Journal of Applied Polymer Science, Journal of Materials Chemistry A, Solid state Ionics, Ionics, Polymer engineering and science, Journal of Physics and Chemistry of Solids, Journal of Solid-State Electrochemistry, Journal of the Taiwan Institute of Chemical Engineers, Journal: ACS Applied Materials & Interfaces, Material research express.

V. **Reviewer for some funders:** Science Technology Development Fund (STDF) and National Research Foundation (NRF) and Academy of Scientific Research and Technology (ASRT).

VI. **Examiner for MSc Dissertation:** Mr. Nkosikhona Nzimande (University of the Witwatersrand), Aya Mohamed (Suez University)

Prizes

- **2023 “Benha University Award for Scientific Excellence”**

Research Projects (PI)

- 8/2010 "Young Research Grant" Issued by Science and Technology Development Fund STDF.(ID:2069) "Magnesium battery based in solid acid membrane"
- 4/2013 " Research Support Grant" Issued by Science and Technology Development Fund STDF.(ID:4758) "Preparation and Characterization of Nanostructure Titanium Dioxide/ Graphene Modified Electrodes for Rechargeable Magnesium Battery"
- 2/2015 " Research Support Grant" Issued by Science and Technology Development Fund STDF.(ID:12564) " Novel Composite Membranes for High Performance Rechargeable Mg Batteries"
- 12/2016 Research Support Grant " Issued by Benha University (Science Research Fund(ID:1076)) " Evaluation the effect of sulfur doping on the physical and electrochemical properties of V_2O_5 cathode for magnesium battery"
- 3/2019 "Chinese-Egyptian Research Fund” (CERF) Grant" Issued by Science and Technology Development Fund STDF.(ID:30340) " " Magnesium insertion beyond ferroelectric phase transition temperature"
- 1/2020 "Research Support Grant" Issued by Science and Technology Development Fund STDF(ID:34761) " "Magnesium hexakis(methanol)-complex electrolyte for realizing practical magnesium ion batteries"
- 5/2020 "ScienceUP-Central Labs" Issued by Academy of Scientific Research and Technology ASRT (ID: 6364) " Equipping the central laboratory, Faculty of Science, Benha University with XRD diffractometer and atomic force microscope"
- 6/2020 "Science Up1-Central Labs " Issued by Academy of Scientific Research and Technology ASRT (ID: 6631) " Magnesium insertion in an open framework MXene towards sustainable and high rate flexible solid state magnesium battery"
- 6/2020 "ASRT-BA RGs" Issued by Bibliotheca Alexandrina BA (ID:1530) "An artificial Interphase for Realizing Practical Magnesium Batteries"
- 10/2022 "ScienceUP2-Central Labs" Issued by Academy of Scientific Research and Technology ASRT (ID: 9674) " Raising the capabilities and laboratory capabilities of the Faculty of Science, Benha University"

Visiting Fellow

- 2022 Visiting Professor to University of Massachusetts Boston, USA, Attention: Prof. Niya Sa (15 days)
- 2019 Visiting fellow to University of Science and Technology Beijing, Beijing, China, Attention: Prof. lizhen Fan (30 days)
- 2016 Visiting fellow to UNSW University, School of Chemistry, Australia Attention: Prof. Neeraj Sharma. (30 days)
- 2015 Visiting fellow to Wollongong University, Institute for Superconducting & Electronic Materials, Australia, Attention: Prof. Zaiping Guo. (30 days)
- 2012 Visiting fellow to University of Science and Technology Beijing, Beijing, China, Attention: Prof. lizhen Fan (8 days)
- 2011 Visiting fellow to Wollongong University, Institute for Superconducting & Electronic Materials, Australia, Attention: Prof. Zaiping Guo. (15 days)
- 2010 Visiting fellow to Caltech University, Steele Lab, Pasadena, CA, USA, Attention: Prof. Sossina Haile (8 days)

Conferences/Workshops

- 2022, Regular Training Miniflex XRD Course, Rigaku Europe SE, Neu-Isenburg, Germany, 10-12 OCT. 2022.
- 20**22**, 4TH INTERNATIONAL SYMPOSIUM ON MAGNESIUM BATTERIES (MAGBATT IV), Helmholtz-Institute Ulm (HIU), Germany, **6**-8 Sep. 2022.
- 2022, Jeol Neoscope JCM7000 + EDS Electron Microscope Training Course, KARFO ENDUSTRIYEL, Istanbul, Turkey, 6-**9** April. 2022.
- 2019, School on Design, Fabrication and Application of Devices for Energy Production (- Trieste), ICTP, Italy, 13-16 May 2019
- 2018, 2nd International symposium on Magnesium Batteries, Helmholtz-Institute Ulm (HIU), Germany, 27-28 Sep. 2018
- 2018, Energy Future Conference, UNSW Sydney, Australia from 5 – 7 February 2018
- 2016, INTERNATIONAL SYMPOSIUM ON NEXT-GENERATION BATTERIES 9th to 14th August 2016 Innovation Campus, North Wollongong, NSW Australia
- Eg-MRS 6-9 Jan 2016 , Aswan, Egypt
- 2014, Energy Materials Nanotechnology (EMN) Fall Meeting 2014" Orlando, Florida. 22 - November 25, 2014.

- 2014, Asia Pacific Conference on Electrochemical Energy Storage and Conversion (APEnergy2014), Brisbane, Australia.
- 2012, Batteries &Fuel cells Seminar, September 4-6-2012 San Diego CA-USA
- 2012, Proceeding Cleantech, Santa Clara Convention Center. Santa Clara, California, U.S.A.
- Eg-MRS 2011, Sharm El-Shikh 3-6 Oct.2011, Egypt
- Guidelines for researcher workshop 2010", Bibliotheca Alexandrina
- 2008, Material Science courses development "Physics department, Sohag University

International indicators of scientific research

Citation indices	Google Scholar	Scopus
Citations	8**89**	615
h-index	15	14
i10-index	27	21

Peer-Reviewed Publications

Book Chapter

A chapter 5 (**Magnesium Battery)** in Electrochemical Devices for Energy Storage Applications, Edited by: Mesfin A. Kebede, Fabian I. Ezema (Taylor & Francis),2020(81-101).
https://www.taylorfrancis.com/books/e/9780367855116/chapters/10.1201/9780367855116-5

List of Publications

[1]. E. Sheha, S. Fan, M. Farrag, E. El-Dek, M.A. Moselhy, D. Sulatt, N. Sa, Life Aging Effect as a Conditioning Process that Regulates the Performance of the Halogen-Free Mg Electrolyte, Langmuir 39(46) (2023) 16637-16647

[2]. Refai, H.; Yacout, N.; Farrag, M.; Ibrahim, S.; Kebede, M. A.; Salman, F.; Sheha, E. Succinonitrile as electrolyte-additive with modified separator and microwave-assisted synthesis of sulfur nanoparticles cathode for magnesium battery applications. *Journal of Energy Storage* **2023**, *70*, 107954.

[3]. Mohammad H. Al Sulami, F.; Alsabban, M. M.; Al-Sulami, A. I.; Farrag, M.; Vedraine, S.; Huang, K.-W.; Sheha, E.; A. Hameed, T. Nanosynthesis and Characterization of Cu1. 8Se0. 6S0. 4 as a Potential Cathode for Magnesium Battery Applications. *Langmuir* **2023**.

[4]. El-Desoky, M.; Abdelrazek, M.; Kamel, R. M.; Sheha, E.; Ali, A. M.; Hannora, A. E. Relationship between structural, electrical and electrochemical properties of La-doped nanocrystalline V2O5 films for energy storage applications. *Journal of Materials Science: Materials in Electronics* **2023**, *34* (20), 1-19.

[5]. Moselhy, M. A.; Farrag, M.; Zhu, Y.; Sheha, E. Probing the effect of ethylene carbonate on optimizing the halogen-free electrolyte performance for Mg sulfur batteries. *RSC advances* **2023**, *13* (31), 21182-21189.

[6]. Alahmadi, M., et al., Evaluation of the performance of VSe2 cathode in halogen-free electrolyte for magnesium battery applications. Materials Letters, 2023. **341**: p. 134300.

[7]. Gamal, R., E. Sheha, and M. El Kholy, Dimethyl sulfoxide as a function additive on halogen-free electrolyte for magnesium battery application. RSC Advances, 2023. **13**(18): p. 11959-11966.

[8]. 3. Gamal, R., E. Sheha, and M.M. El Kholy, Probing the Functionality of Halogen-Free Electrolytes Using Succinonitrile Additive in Magnesium-Sulfur Batteries. Journal of Electronic Materials, 2023.

[9]. Sheha, E. M.; Farrag, M.; Refai, H. S.; El-Desoky, M. M.; Abdel-Hady, E. Positron Annihilation Spectroscopy as a Diagnostic Tool for Probing the First-Cycle Defect Evolution in Magnesium–Sulfur Battery Electrodes. physica status solidi (a) 2023, 220 (3), 2200661.

[10]. M. Farrag, H. S. Refai, and E. Sheha, "The role of adding NaF to the electrolyte in constructing a stable anode/electrolyte interphase for magnesium battery applications," Journal of Solid State Electrochemistry, 2022/11/14 2022, doi: 10.1007/s10008-022-05329-1.

[11]. N. Yacout, H.S. Refai, M.A. Kebede, F. Salman, E. Sheha, Significant study of $BaTiO_3$ as a cathode for magnesium battery applications, Materials Chemistry and Physics (2022) 126770.

[12]. Wally, N.K., et al., Impedance spectroscopy of Na2S – V2O5 – P2O5 glass-ceramic nanocomposites. Journal of Non-Crystalline Solids, 2022. **598**: p. 121941.

[13]. Khalil, R.M., et al., Microstructure, electrical, optical and electrochemical characteristics of silver phosphate glasses cathode for magnesium battery applications. Journal of Physics D: Applied Physics, 2022. **55**(49): p. 495303.

[14]. N.K. Wally, E. Sheha, B.M. Kamal, A.E. Hannora, M.M. El-Desoky, Exploring the electrochemical properties of Na2S -V2O5-P2O5 glass-ceramic nanocomposites as a cathode for magnesium-ion batteries, Journal of Alloys and Compounds 895 (2022) 162644.

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[18]. Sheha, E.; Farrag, M.; Fan, S.; Kamar, E.; Sa, N., A Simple Cl–-Free Electrolyte Based on Magnesium Nitrate for Magnesium–Sulfur Battery Applications. ACS Applied Energy Materials 5 (2), 2022, 2260-2269.

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[25]. Dual Polymer/Liquid Electrolyte with BaTiO3 Electrode for Magnesium Batteries, E Sheha, F Liu, T Wang, M Farag, J Liu, N Yacout, M Kebede, N Sharma, ACS Applied Energy Materials, 3 (6), 5882-5892

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