

**PROFESSOR SALAH S. TH. AL-
THYABAT**

SUMMARY

I am currently the professor of Mining and Minerals Processing Engineering in the Mining Engineering Department /Al-Hussein Bin Talal University (AHU)-Jordan. I earned my PhD degree in Mining and Minerals Processing Engineering from Nottingham University, UK, in 2005. My research interests are flotation of industrial minerals (phosphate, potash, and silica sands); beneficiation of oil shale by flotation; mine wastewater treatment; Urban mining including application of minerals processing separation processes in recycling of electronic waste (e.g. printed circuits, lithium –ion batteries), extraction of metals from oil shale ash, extraction of REE from phosphate fertilizers waste ;application of digital image processing in minerals process; optimization of phosphate and potash fertilizers production.. During my career, I have gained extensive teaching and research experience in my home country, Jordan, and worldwide including USA, UK, Australia, Germany, and Japan. This enabled me to establish an international network of research collaboration throughout the world within different cultures and backgrounds. ***I have been PI/CI of 11 research projects funded by the Jordanian Government, mining companies (Jordanian phosphate Mines, Arab Potash), AHU, and the US Department of Energy (UDOE). The overall budget of these projects is about US\$350 000. So far, I published 20 technical papers in international peer reviewed journals, participated in 13 international conferences, and wrote two book chapters.*** because of my mechanical Engineering background, I recently acquired translation rights from Elsevier to translate a famous book in solar energy from English to Arabic -Solar Energy Engineering: processes and systems, by S. Kalogirou., which it is expected to be published in 2017.



My major achievement since earning PhD are as follows:

- I. Working with Prof. Nick Miles from University of Nottingham –UK to develop on –line particle size analyser based on digital image processing. two papers were published
 - ❖ *An improved estimation of size distribution from particle profile measurements (2006), Powder Technology 166 (3), 152-160 (cited by 51).*
 - ❖ *Estimation of the size distribution of particles moving on a conveyor belt (2007), Minerals Engineering 20 (1), 72-83(cited by 50).*
- II. Working with Prof. Emmy Manaplag from JK-minerals research centre –Queensland University /Australia to develop a flotation scheme for Jordanian phosphate by mechanical and column flotation.
- III. Working with Prof.Yoon from Virginia technical university –USA to investigate the chemistry of phosphate flotation in column cells. two papers were published
 - ❖ *A comparison of anionic and cationic flotation of a siliceous phosphate rock in a column flotation cell (2011), Mining Science and Technology (China) 21 (1), 147-151(cited by8).*
 - ❖ *Floatability of fine phosphate in a batch column flotation cell, Minerals & Metallurgical Processing Journal 28 (2), 110-116] (cited by2).*

- IV. Working with Dr. Reinhard Miller of Max-Planck institute for collides and interfaces –Germany to measure dynamic surface tension of phosphate flotation collectors and its role in flotation performance.
- V. Working with prof. Nakamura from Tohoko University –Japan to develop a methodology to modify minerals processing techniques to recycle lithium –ion and Nickle metal hydride batteries and extract their valuables. A review paper was published [*Adaptation of minerals processing operations for Lithium-ion (LiBs) and Nickel metal hydride (NiMH) batteries recycling: critical review (2013), Minerals Engineering, 45, 4-17(cited by 44)*]
- VI. In 2014, I was a principal investigator of a research project funded by USDOE titled “Extraction of rare earth elements from Florida phosphate”. The project was conducted in the Florida Industrial and Phosphate Research Institute (FIPR) in collaboration with Dr. Patrick Zhang; I was chosen for this project under a highly selective type of visa for international talents (*O1- Visa – Alien with outstanding ability*). The results was published in FIPR-12-02-186 report titled “REE extraction from Florida phosphate”. The following papers were recently published
- ❖ In-line extraction of REE from Dihydrate (DH) and HemiDihydrate (HDH) wet process (2015), hydrometallurgy 153] (*cited by 07*)
 - ❖ REE extraction from phosphoric acid, phosphoric acid sludge, and PG. Minerals processing and extractive metallurgy (2015), 124(3), pp. 143-150. (*cited by 07*)
 - ❖ Rare earth elements extraction from upgraded phosphate flotation tailings (2016). Minerals and metallurgical processing (2016),33(1), pp.23-30. (*cited by 02*)
- VII. Supervising several undergraduate research projects; four of them Awarded Jordanian Engineers Syndicate prize for graduation projects:
- ❖ REE extraction from Jordanian oil shale ash (2016).
 - ❖ characterization of phosphogypsum produced from Eshydia fertilizer plant for its reuse (2016)
 - ❖ REE extraction from Jordanian Phosphate waste: slime and tailing (2014).
 - ❖ Flotation of Jordanian siliceous phosphate (2008).

PERSONAL INFORMATION

Name: Al-Thyabat , Salah S.TH.

Date of birth: 7/August/1973.

Email: althyabat@yahoo.co.uk; salah.thyabat@ahu.edu.jo

<http://www.ahu.edu.jo/colleges/engineering/Mining/AcademicStaff.aspx>

Mobile: +962799249604

EDUCATION

- | | |
|---------------------|---|
| 1/9/2001-15/12/2005 | PhD (Mining and Minerals Processing Engineering); Theses title: “Measurement of bulk particulate size distribution by digital image processing: Supervisor: Prof. Nick Miles .Faculty of Engineering, Department of Chemical and Environmental Engineering, The University of Nottingham –UK. |
| 1/9/1991 -15/6/1995 | Bachelor (Mechanical Engineering)-very good(GPA)/Faculty of Engineering, Department of Mechanical Engineering, Mutah University –Jordan |

CURRENT POSITION

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| 20/05/2015-current | Professor of Mining and Minerals Processing Engineering .Faculty of Engineering, Department of Mining Engineering, Al-Hussein Bin Talal University (AHU)-Jordan |
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PREVIOUS POSITIONS

5/2/2011-5/12/2015	Associate professor of Mining and Minerals Processing Engineering .Faculty of Engineering, Department of Mining Engineering, Al-Hussein Bin Talal University (AHU)-Jordan.
5/2/2006-5/2/2011	Assistant professor of Mining and Minerals Processing Engineering .Faculty of Engineering, Department of Mining Engineering, Al-Hussein Bin Talal University (AHU)-Jordan.
1/9/2001-15/12/2005	PhD candidate .Faculty of Engineering, Department of Chemical and Environmental Engineering, The University of Nottingham – UK
1/9/1998-31/8/2001	Vocational school teacher .Ministry of Education-Maan, Jordan
1/8/1995-31/8/1998	Maintenance Engineer. Ministry of Interior, Amman, Jordan

FELLOWSHIP AND AWARDS

26/5/2012-25/7/2012	Japan Society for the promotion of Science (JSPS)/Short term invitation for international researchers. Institute of Multidisciplinary research for advanced materials (IMRAM)/Metallurgy and Recycling System for Metal Resources Circulation Laboratory, Tohoku University –Japan ((1400000 Japanese Yen (11800 \$US))).
10/6/2010-11/8/2010	German Research Foundation (DFG), Max-Planck Institute for colloids and interfaces /Germany (9500 Euro (10200 \$US)).
12/10/2008-12/2/2009	Fulbright scholar awards, Department of Mining and Minerals Engineering, Centre for Advanced Separation Technologies, Virginia Polytechnic Institute and State University –USA ((\$US 12000)).
10/6/2008-10/10/2008	Australia Endeavour Research award, JK Minerals Research centre -Queensland University (Brisbane) /Australia.((\$ AUD 20000 (14000 \$US)))
3/3/2010-3/3/2011(waiting list)	Visiting fellowship in Canadian government laboratories – NSERC-Canada
1/6/2011-1/8/2011	Visiting scholar (invited), , Department of Mining and Minerals Engineering, Centre for Advanced Separation Technologies, Virginia Polytechnic Institute and State University –USA(\$US 3000).
1/9/2001-15/12/2005	AHU Award –pursue PhD in The University of Nottingham – UK(100000 Jordanian Dinar)(140000 \$US)
1/10/2012-1/8/2013	Researcher (Sabbatical leave) (O1-visa, Alien with outstanding ability), Florida Industrial and Phosphate Research Institute (FIPR), Florida Polytechnic University, Florida-USA. <i>PI of “REE extraction from Florida phosphate”. USDOE funded project (US \$40000)</i>

PUBLICATIONS

Technical papers (peer – reviewed)

1. **Al-Thyabat**, Zhang. 2016. Rare earth element extraction from upgraded phosphate flotation tailings. **Minerals and metallurgical processing** 33(1), PP.23-30.
2. **Al-Thyabat**, Zhang. 2015. In-line extraction of REE from Dihydrate(DH) and HemiDihydrate(HDH) wet processes. **Hydrometallurgy** 153, PP 30-37.
3. **Al-Thyabat**, Zhang. 2015. REE extraction from phosphoric acid, phosphoric acid sludge, and phosphogypsum. **Minerals processing and extractive metallurgy**,124(3), pp. 143-150.
4. **Al-Thyabat**, Al-Zoubi, Alnawafleh and Al-Tarawneh, 2014. Beneficiation of Oil Shale by Froth Flotation: Critical Review. **The Open Mineral Processing Journal**, 2014, 7, 1-12
5. **Al-Thyabat**, Nakamura, Shibata, Iizuka, 2013. Adaptation of minerals processing operations for Lithium-ion (LiBs) and Nickel metal hydride (NiMH) batteries recycling: critical review, **Minerals Engineering** 45, pp 4-17.
6. **Al-Thyabat**, Al-Zoubi, 2012. Purification of Phosphate Beneficiation Wastewater: Separation of phosphate from Eshydia Mine (Jordan) by Column-DAF Flotation. **International journal of Minerals Processing**, 110-111, pp18-24.
7. Al-Zoubi, **Al-Thyabat**, 2012, Treatment of a Jordanian Phosphate Mine Wastewater by a hybrid Dissolved Air Flotation and Nanofiltration, **Mine Water and the Environment** ,31(3), 214-224.
8. **Al-Thyabat**, 2012, Evaluation of Mechanical Flotation of non-slimes Jordanian phosphate, **The Arabian Journal for Science and Engineering**, 37(4), pp 877-887.
9. Al-Rawashdeh, **Al-Thyabat**, 2012. Mining in Jordan: prospects and challenges, **International Journal of Mining and Minerals Engineering**, 4 (2), pp. 116-138.
10. **Al-Thyabat**, Yoon, Shin, 2011, A comparison between anionic and cationic flotation of siliceous phosphate in column flotation cell, **Journal of Mining Science and Technology**, 21, pp.147-151.
11. **Al-Thyabat**, Yoon, Shin, 2011, Floatability of Fine phosphate in column flotation cell, **Minerals and Metallurgical processing**, 28(2), pp 110-116.
12. **Al-Thyabat**, 2010, Column flotation of non-slimes Jordanian phosphate, **The Jordan Journal of Earth and Environmental Sciences**, 3(1), pp 17-24.
13. **Al-Thyabat**, 2009. The role of sodium silicate in flotation of Jordanian siliceous phosphate, **Separation and Purification Technology**, 67(3), pp. 289-294.
14. Al-Zoubi, **Al-Thyabat**, Al-Khatib, 2009, A hybrid flotation–membrane process for wastewater treatment: an overview, **Desalination and Water Treatment**, 7, pp.60-70).
15. **Al-Thyabat**, 2009. Investigating the effect of some operating parameters on flotation kinetics by neural networks. **Advanced Powder Technology**, 20(4), pp.355-360.
16. **Al-Thyabat**, 2008. Statistical evaluation of conditioning time and slurry concentration in the flotation performance of siliceous phosphate. **Minerals and Metallurgical Processing**, 25(3), pp123-129.
17. **Al-Thyabat**, 2008.Optimization of phosphate flotation by using neural network. **Journal of China University of Mining and Technology (JCMUT)**, 18(3), 418-426.
18. **Tarawneh**, **Al-Thyabat**, Al-Harashseh, 2007. Mineralogical, physical and mechanical properties of limestone rocks in Ma'an Area, south Jordan. University of mining and geology, Sofia, Bulgaria. Volume 50, **Geology and Geophysics**.

19. **Al-Thyabat**, Miles and Koh, 2007. Estimation of the size distribution of particles moving on a conveyor belt. **Minerals Engineering**, 20 (3), 72-83.

20. **Al-Thyabat**, Miles, 2006. An improved estimation of bulk particulate size distribution. **Powder Technology**, 166(3), pp152-160.

Book chapters

1. **S. Al-Thyabat**, K. Tarawneh. (2010). Optimization of Jordanian phosphate flotation. Beneficiation of Phosphates: Technology Advance and adoption Edited by: P. Zhang, K. Swager, L. Filho, H. El-Shall, published by Society for Mining, Metallurgy, and Exploration, Inc. (SME)

2. **S. Al-Thyabat**, M. Harareh, K. Tarawneh, H. Al-Zoubi, 2011, Preliminary investigations into the use of Jojoba oil as possible collector for phosphate flotation. Beneficiation of phosphate: New ideas, new developments, new technologies. Edited by: P. Zhang, published by Society for Mining, Metallurgy, and Exploration, Inc. (SME)

International conferences

1. **Al-Thyabat**, Zhang, 2017. A comparison between REE extraction from phosphate rock before and after phosphoric acid production. 4th International Symposium on Innovation and Technology in the Phosphate Industry from May 8th to 10th, 2017 – Ben Guérir - UM6P Congress Centre. **(accepted for Oral presentation)**.

2. **Al-Thyabat**, Ghrair. Recycling of Printed Circuit Boards (PCB): Extraction of metallic and nonmetallic fractions by a combination of physical and chemical processes: XXVIII International Mineral Processing Congress (IMPC16), Canada, September 11-15 **(accepted for oral presentation)**.

3. **Al-Thyabat**, Zhang. The use of lanthanum (La^{+3}) and cerium (Ce^{+3}) ions as phosphate activators in low-grade phosphate flotation. Beneficiation of phosphate VII March 28-April 2, 2015, Melbourne-Australia. **(Oral presentation)**

4. **S. Al-Thyabat**, E. Albdrazag, M. Abuallan, Using waste frying oil as flotation collector in Jordanian oil shale beneficiation, Conference in Minerals Engineering 7-8 February 2012, Lulea-Sweden **(oral presentation)**.

5. **S. Al-Thyabat**, H. Al-Zoubi, 2010, Application of Dissolved Air Flotation (DAF) in halite removal from Dead Sea brine, 60th Canadian chemical Engineering Conference, (CSCHE2010), Saskatoon, Saskatchewan, Canada, October 24 -27, 2010. **(oral presentation)**.

6. **S. Al-Thyabat**, H. Al-Zoubi, 2010. Jordanian Phosphate wastewater treatment: I: phosphate recovery from slime by column-DAF Flotation technology, 60th Canadian chemical Engineering Conference, (CSCHE2010), Saskatoon-Canada, October 24 -27, 2010. **(Oral presentation)**

7. H. Al-Zoubi, **S. Al-Thyabat**, 2010. Jordanian Phosphate wastewater treatment: II: A hybrid process of Dissolved Air Flotation (DAF) - Nanofiltration membrane, 60th Canadian chemical Engineering Conference, (CSCHE2010), Saskatoon, Saskatchewan, Canada from October 24 to 27, 2010. **(Oral presentation)**.

8. **Al-Thyabat**, Yoon (2010). A comparison between anionic and cationic flotation of siliceous phosphate in column cell. Processing of industrial minerals 10, Istanbul, Turkey, February 4-5, 2010 **(oral presentation)**.

9. **Al-Thyabat**, J. Alali (2009). Oil shale flotation: prospects and challenges, The International Conference on Materials in Jordan, Amman, 4 - 6 March 2009. **(Oral presentation)**

10. Al-Zoubi, **Al-Thyabat**, Al-khateeb (2008). Overview of hybrid Flotation- Membrane process for wastewater treatment: in Jordanian phosphate industry. EUROMED2008, 9-13, NOV, 2008, Jordan-Dead Sea. (Poster).

11. **Al-Thyabat**, K. Tarawneh, 2007. Optimization of Jordanian phosphate flotation. Beneficiation of phosphate V, Rio de Janeiro, Brazil, February 17-21 /2008 (**Poster**).
12. **Al-Thyabat**, Tarawneh, Harareh, Rawashdeh, (2007) Beneficiation of Jordanian Phosphate: A review of current practices. 5th international Jordanian mining conference, Amman, Jordan, September 6-9, 2007 (**oral presentation**).
13. **Al-Thyabat**, Rawashdeh, 2007. The effect of collector dosage, particle size, and impeller speed on the performance of Jordanian phosphate flotation: Lab scale study. Flotation 07, Cape Town, South Africa, November 6-9 2007. (**Poster**).

In progress

1. **Al-Thyabat**, 2014-2017. Solar Energy Engineering: by Stories Kalogeria. (Book-Translation from English to Arabic). (Elsevier Inc.-signed translation contract)-in progress.
2. **Al-Thyabat**. EXCEL^R, 2014-2017 analysis techniques for engineering and science students. (Book in English). in progress.
3. AL-Maasfeh, Abu-Zaid, **Al-Thyabat**, 2017. Prediction of Photovoltaic (PV) cell performance by Artificial Neural Network (ANN). MSC thesis, Mut'ah University.

RESEARCH PROJECTS

1. **Zhang, P., Al-Thyabat (PI)**, 2013. Rare earth Elements (REE) extraction from Florida Phosphate, Florida Industrial and Phosphate Research (FIPR-12-02-186), Funded by US Department of Energy (USDOE) –USA (**Completed**).
2. **Al-Thyabat (PI)**, E. Al -Zoubi, 2011, Development of collectors for phosphate, potash, and oil shale from cheap local materials. Funded by Abdul Hamed Shoman Foundation and Arab Potash Company (APC) –Jordan. (**Completed**).
3. Yoon, **Al-Thyabat (PI)**, 2011. Development of a novel collector for flotation of North Carolina Phosphate, Funded by Center for advanced separation Technologies (CAST), Virginia Tech. University –USA (**completed**).
4. Al-Zoubi, **Al-Thyabat (CI)**, 2010. Treatment of Eshydia phosphate wastewater by Dissolved air flotation (DAF) and Membrane, Funded by Ministry of Higher Education Research Fund-USA (**completed**).
5. Miller, **Al-Thyabat (PI)**, 2010, The role of dynamic surface tension in minerals flotation. Funded by Max-Planck Institute for colloid and interfaces –/Germany. (**completed**)
6. M. Harareh, Al-Hrahasheh, Fraije, **Al-Thyabat (CI)**, 2010. Investigating the flow in hydrocyclone .Funded by Ministry of Higher Education Research Fund –Jordan (completed).
7. Tarawneh, Al-Harashsheh, **Al-Thyabat (CI)**, 2008. Minerals resources in Ma'an governorate: A mineralogical study. Funded by Al-Hussein University-Jordan (**completed**).
8. **Al-Thyabat (PI)**, Harareh, Tarawneh .2007. Beneficiation of Jordanian phosphate. Funded by Al-Hussein University and Abdul Hamed Shoman Foundation-Jordan (**completed**).

INTERNATIONAL JOURNAL PEER-REVIEW

I am a reviewer for the following international Journals: [1] International journal of minerals processing [2] Minerals Engineering [3] Desalination & wastewater treatment [4] Powder Technology [5] Separation Science and Technology [6] Separation and Purification Technology [7] Advanced Powder Technology [8] Measurement journal [9] Industrial & Engineering Chemistry Research [10] The open Journal of minerals processing [11] Resources, Conservation & Recycling [12] Micron Journal [13] Journal of Hazardous materials [14] Journal of King Saud University: Engineering Sciences [15] Engineering Geology Journal [16] Journal of the Air & Waste Management Association

TEACHING ACTIVITIES

[1] Minerals Processing [2] Mine Design. [3] Mine transport systems [4] Mine safety Engineering [5] Introduction to Mining Engineering [6] Numerical methods using MATLAB^R [7] Engineering analysis (advanced mathematics for computer engineering students) [8] Engineering drawing using AutoCAD^R. [9] Engineering Mechanics (for all engineering students) [10] Programming languages (C, visual basic for Excel^R) . [11] Digital images processing using Matlab^R (computer engineering students). [12] Statics (for all engineering students). [13] Dynamics (for all engineering students). [14] Mechanics of Materials (for all engineering students).

SUPERVISION OF UNDERGRADUATE STUDENTS RESEARCH PROJECTS

5/2/2016- 30/6/2016	<i>“characterization of phosphogypsum produced from Eshydia fertilizer plant for its reuse “</i> , Department of Mining Engineering, AHU University –Jordan, Funded by King Abdullah II for Research and Development –Jordan. <i>Awarded (JES) prize for graduation projects (2016). (completed)</i>
1/2/2015- 30/9/2015	<i>“REE extraction from Jordanian oil shale ash “</i> , Department of Mining Engineering, AHU University –Jordan, Funded by King Abdullah II for Research and Development –Jordan. <i>Awarded (JES) prize for graduation projects (2016). (completed)</i>
1/2/2015- 30/6/2016	<i>“Recycling of printed circuit boards “</i> , Department of Mining Engineering, AHU University –Jordan,)- completed
1/9/2013- 1/6/2014	<i>“REE extraction from Jordanian Phosphate waste: slime and tailings “</i> , Department of Mining Engineering, AHU University – Jordan, Funded by King Abdullah II for Research and Development –Jordan. <i>Awarded Jordanian Engineers Syndicate (JES) prize for graduation projects (2014)-completed</i>
1/9/2010-1/6/2011	<i>“Hybrid membrane –DAF (dissolved air Flotation) treatment for Eshydia phosphate mine (Jordan) wastewater”</i> . Department of Mining Engineering, AHU University –Jordan, Funded by King Abdullah II for Research and Development –Jordan. -completed
1/9/2007-1/5/2008	<i>“Flotation of Jordanian siliceous phosphate “</i> , Department of Mining Engineering, AHU University –Jordan, <i>Awarded (JES) prize for graduation projects (2008). -completed</i>

ORGANISATION OF SCIENTIFIC MEETINGS

25/9/2013-11/9/2014	Chairman of scientific committee, Faculty of Engineering, AHU
22/5/2007 -23/5/2007	Member of organizing committee (convener), Minerals beneficiation workshop, Department of Mining Engineering, AHU University –Jordan.
29/3/2015-3/4/2015	Member of organizing committee, Beneficiation of Phosphates VII, Melbourne, Australia
19/9/2008	Organizer and presenter, One day workshop “Introduction to Matlab ^R “, for graduate students , JK minerals research center , Queensland University , Australia
22/7/2011	Invited lecturer “the role of surface chemistry in flotation of siliceous phosphate”, Centre for advanced separation Technologies (CAST), Virginia Tech. University –USA Centre

1/10/2006-1/2/2007	Organizer and coordinator, “Mining Engineering at AHU university: the role and prospects:” a series of presentations to High school students in south of Jordan. AHU university-Jordan.
25/2/2007-25/8/2007	Chairman, committee for establishing Engineering workshop at AHU, Faculty of Engineering, Al-Hussein University (AHU).
4/3/2009-6/3/2009	Convener, the International Conference on Materials in Engineering, Amman-Jordan

INSTITUTIONAL RESPONSIBILITIES

5/2/2006-11/9/2015	Faculty member, Al-Hussein University (AHU)-Jordan
1/9/2006-25/8/2007	Assistant Dean (Acting Vice dean), Faculty of Engineering, AHU-Jordan
1/9/2007-1/6/2008	Vice Dean, Deanship of scientific research, Al-Hussein University (AHU)-Jordan
1/9/2007-1/6/2008	Director, Scholarship Department, Deanship of scientific research, AHU University -Jordan.
1/1/2010-1/9/2011	Director, Procurement Department, AHU University -Jordan.

MEMBERSHIPS OF SCIENTIFIC SOCIETIES

1/9/2010-11/9/2015	Jordanian Fulbright Alumni Association (JFAA)-Jordan
1/6/2009-11/9/2015	Australia Awards alumni Networks (AAAN)-Australia
1/1/2008-31/12/2010	American society for Mining, Metallurgy & Exploration (SME)-USA
1/6/2009-1/9/2011	Jordan Society of Scientific research (JSSR)-Jordan
1/6/2009-1/6/2011	The British Universities Alumni Association (BUAA)-Jordan