

CURRICULUM VITAE

• **Personal Details**

Name: Shmuel Hayun

Date and place of birth: 09.03.1975, Israel

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• **Education**

B.Sc. 1999-2003 - Ben-Gurion University of the Negev - Physics

B.Sc. 1999-2003 - Ben-Gurion University of the Negev - Materials Engineering

Prof. Moshe Dariel, Prof. Nahum Frage.

The use of SHS for joining ceramics

M.Sc. 2003-2005 - Ben-Gurion University of the Negev - Materials Engineering.

Prof. Moshe Dariel, Prof. Nahum Frage and Prof. Eugene Zaretsky.

Dynamic response of B₄C-SiC ceramic composites.

Ph.D. 2005-2009 Ben-Gurion University of the Negev - Materials Engineering.

Prof. Nahum Frage, Prof. Moshe Dariel and Prof. Eugene Zaretsky.

The inter-relationships between the static and dynamic mechanical properties and the microstructure of reaction bonded boron carbide composites.

• **Employment History**

Since Oct. 2011

Senior lecturer - Department of Materials Engineering,
Ben-Gurion University of the Negev, Israel

2009-2011

Postdoctoral researcher -Peter A. Rock Thermochemistry Laboratory,
University of California, Davis, CA,USA

2003-2009

Teaching Assistant - Department of Materials Engineering,
Ben-Gurion University of the Negev, Israel

• **Professional Activities**

(a) Positions in academic administration

Departmental

1/2014 – 5/2014, Head of teaching committee, Department of Materials Engineering, Ben-Gurion University of the Negev.

Since 2011, Head of teaching committee of the joint program Materials - Mechanical Engineering at the Department of Materials Engineering, Ben-Gurion University of the Negev.

Faculty

Since 2011, Member of the stirring comity of the Faculty of Engineering machinshop, Ben-Gurion University of the Negev.

(b) Professional functions outside universities/institutions

2011- 2013, Research associate without salary, Peter A. Rock Thermochemistry Laboratory, University of California, Davis, CA,USA

(e) Ad-hoc reviewer for journals

Journal of the European Ceramic Society
Ceramics International
Applied Physics A
Surface Review and Letters
Materials Research Letters

(f) Membership in professional/scientific societies

Since 2014, Materials Research Society
Since 2008, American Ceramic Society
2005-2007, American Physical Society

• Educational activities

(a) Courses taught

1. Ceramic materials - Undergraduate - Ben-Gurion University of the Negev.
2. Materials engineering laboratories - Undergraduate - Ben-Gurion University of the Negev.
3. Physical properties of nanomaterials for energy applications -Graduate - Ben-Gurion University of the Negev.
4. Thermal analysis for materials science- Graduate - Ben-Gurion University of the Negev.

(b) Research students

Post Doc.

1. Shei Meir- Start Oct. 2013

Ph. D.

2. Itzik Edry – Start Feb. 2013
Ben-Gurion University of the Negev (Jointly with Prof. N. Frage)
3. Mahdi Halabi - Start Oct. 2014

M. Sc.

4. Sivan Sagi - Start Oct. 2013
5. Yuval Mordekovitz - Start Oct. 2013
6. Yael Shoal - Start Oct. 2013
7. Tomer Mordechai - Start Oct. 2013

Alumni:

1. Mahdi Halabi, M.Sc., 2014, BGU

Awards, Citations, Honors, Fellowships**(a) Honors, Citation Awards**

2009 - Wolf foundation - award for excellence in Ph. D. research

2005 - Israel Materials & Processes Society - First prize award on undergraduate research: "Self-propagating high-temperature synthesis for joining ceramics"

(b) Fellowships

2010 - ISEF - 8,500 \$ - postdoctoral

2009 - ISEF - 10,000 \$ - postdoctoral

Scientific Publications**According to Google Scholar H index at 2014 is equal to 10****(c) Chapters in collective volumes - Conference proceedings, Festschrifte, etc. -**

1. **S. Hayun^S**, N. Frage^{PI}, H. Dilman^C, V. Tourbabin^S and M. P. Dariel^{PI}. 2005, "Dense B₄C-SiC-TiB₂ composites" Edited by V. V. Skorkhod - Proceedings of the International Conference HighMatTech, Kiev, Ukraine, 235. Publisher, Ukraine Academy of Science 235.
2. **S. Hayun^S**, N. Frage^{PI}, M. P. Dariel^{PI}, E. Zaretsky^{PI}, Y. Ashuah^C, 2006, "Dynamic response of B₄C-SiC ceramic composites", Edited by Eugene Medvedovski - Ceramic Armor and Armor Systems II Publisher: American Ceramic Society, 147-156.
3. **S. Hayun^S**, N. Frage^{PI}, H. Dilman^C, V. Tourbabin^S and M. P. Dariel^{PI}, 2006, "Synthesis of dense B₄C-SiC-TiB₂ composites". Edited by Eugene Medvedovski - Ceramic Armor and Armor Systems II Publisher: American Ceramic Society, 37-44.
4. A. Weizmann^S, **S. Hayun^S**, M. P. Dariel^{PI} and N. Frage^{PI}, 2007, "Optimization of the Particle Size Distribution for improving the Mechanical Properties of Reaction-Bonded Boron Carbide (RBBC) Composites", Edited by M. Zinigrad, E.A. Pastukhov - Proceedings of the Sixth Israel-Russian Bi-National Workshop Publisher Israeli Academy of Science and Humanities, 23-33.
5. **S. Hayun^S**, N. Frage^{PI}, M. P. Dariel^{PI} and E. Zaretsky^{PI}, 2007, "Dynamic Mechanical Behavior of Boron Carbide Based Composites", Edited by M. L. Elert, M. D. Furnish, R. Chau, N. Holmes and J. Nguyen - Shock Compression of Condensed Matter Publisher: American Institute of Physics - 747-750.
6. **S. Hayun^S**, N. Frage^{PI}, M. P. Dariel^{PI}, 2008, "Effect of the Carbon Source on the Microstructure and Mechanical Properties of Reaction Bonded Boron Carbide" Edited by Rajendra K. Bordia and Eugene A. Olevsky - Advances in Sintering Science and Technology, Publisher: American Ceramic Society - 29-41.
7. **S. Hayun^S**, M. P. Dariel^{PI} and N. Frage^{PI}, 2008, "Microstructure and properties of boron carbide processed by FAST (Field Assisted Sintering Technology)" Edited by J. Grin - Advanced Processing for Novel Functional Materials, APNFM 2008 Publisher: IFAM 6pp.

8. **S. Hayun^S**, A.Weizmann^S, H. Dilman^C, M. P. Dariel^{PI} and N. Frage^{PI},2009, "Rim region growth and its composition in reaction bonded boron carbide composites with core-rim structure"Journal of Physics: Conference Series 176, (7pp) doi:10.1088/1742-6596/176/1/012009.
9. V. Paris^S, **S. Hayun^S**, M. P. Dariel^{PI}, N. Frage^{PI}, and E. Zaretsky^{PI},2009,“On the Compressive and Tensile Strength of Magnesium Aluminate Spinel” Edited by M. Elert, M. D. Furnish, W. W. Anderson, W. G. Proud, W. T. Butler- Shock Compression of Condensed MatterPublisher: American Institute of Physics - 1003-1006.

(d) Refereed articles and refereed letters in scientific journals

1. **S. Hayun^S**, N. Frage^{PI} and M.P. Dariel^{PI}, 2006, "The morphology of ceramic phases in BxC-SiC-Si infiltrated composites" Journal of Solid State Chemistry, 179(9) 2875-2879. (28 citations, I.F 2.20, 67/136, Q2).
2. O. Hachimi^S, **S. Hayun^S**, A. Venkert^{PI} and M.P. Dariel^{PI}, 2007, "Microstructural study of Ce-Nd alloys". Journal of Alloys and Compounds 427(1-2) 104-109. (0 citations, I.F 2.726, 5/75 Q1).
3. N. Frage^{PI}, **S. Hayun^S**, S. Kalabukhov^T, M.P. Dariel^{PI}, 2007, "The effect of Fe addition on densification of B₄C powder by spark plasma sintering (SPS)" Powder Metallurgy and Metal Ceramics, 46(11-12), 1068-1302. (7 citations, I.F 0.202, 23/25 Q4).
4. **S. Hayun^S**, D. Rittel^{PI}, N. Frage^{PI} and M. P. Dariel^{PI}, 2008 "Static and dynamic mechanical properties of infiltrated B₄C-Si composites", Materials Science and Engineering A, 487(1-5), 405-409. (28 citations, I.F 2.409, 55/251 Q1).
5. M. Aizenshtein^S, I. Mizrahi^S, N. Froumin^C, **S. Hayun^S**, M.P. Dariel^{PI} and N. Frage^{PI}, 2009,"Interface Interaction in the B₄C/(Fe-B-C) system", Materials Science and Engineering A, 495 (1-2),7074. (7 citations, I.F 2.409,55/251 Q1).
6. **S. Hayun^S**, A.Weizmann^S, M. P. Dariel^{PI} and N. Frage^{PI}, 2009, "The Effect of Particle Size Distribution on the Microstructure and the Mechanical Properties of Boron Carbide-Based Reaction-Bonded Composites”, International Journal of Applied Ceramic Technology, 6[4], 492-500. (9 citations, I.F 1.215,8/25, Q2).
7. **S. Hayun^S**, H. Dilman^T, M. P. Dariel^{PI} and N. Frage^{PI}, 2009, “The effect of aluminum on the microstructure and phase composition of boron carbide infiltrated with silicon”, Materials Chemistry and Physics, 118(2-3), 490-495. (4 citations, I.F 2.129, 71/251, Q2).
8. **S. Hayun^S**, V. Paris^S, M. P. Dariel^{PI}, N. Frage^{PI} and E. Zaretsky^{PI}, 2009, "Static and dynamic mechanical properties of boron carbide processed by spark plasma sintering”, Journal of the European Ceramic Society,- 29(16), 3395-3400. (15 citations, I.F 2.307,2/25, Q1).
9. **S. Hayun^S**, A. Weizmann^S, M. P. Dariel^{PI} and N. Frage^{PI}, 2010,“Microstructural Evolution During the Infiltration of Boron Carbide with Molten Silicon", Journal of the European Ceramic Society - 30(4), 1007-1014. (22 citations, I.F 2.307, 2/25, Q1).
10. **S. Hayun^S**, S. Kalabukhov^T, V. Ezersky^T, M.P. Dariel^{PI} and N. Frage^{PI}, 2010 , “Microstructural Characterization of Spark Plasma Sintered Boron Carbide Ceramics”, Ceramics International, 36(2), 451-457. (26 citations, I.F 2.089,3/25 Q1).

11. **S. Hayun**, M.P. Dariel, N. Frage and E. Zaretsky, 2010 , "The High Strain Rate Dynamic Response of Boron Carbide Based Composites", *Acta Materialia*, 58(5), 1721-173. (8 citations I.F 3.94, 1/75 Q1).
12. **S. Hayun**^{PI}, T. Y. Shvareva^C, A. Navrotsky^{PI}, 2011, "Nanoceria Energetics of Surfaces, Interfaces and Water Adsorption", *Journal of the American Ceramic Society*, 94(11), 3992-3999. (11 citations, I.F 2.428, 1/25, Q1).
13. **S. Hayun**^{PD}, S. V. Ushakov^C, A. Navrotsky^{PI}, 2011, "Direct Measurement of Surface Energy of CeO₂ by Differential Scanning Calorimetry " *Journal of the American Ceramic Society* - 94(11), , 3679-3682. (4 citations, I.F 2.428, 1/25, Q1).
14. **S. Hayun**^{PD}, T. Tran^{PD}, S. V. Ushakov^C, A. M. Thron^S, K. van Benthem^C, A.Navrotsky^C, and R. H. R. Castro^{PI}, 2011,"Experimental Methodologies for Assessing the Surface Energy of Highly Hygroscopic Materials: The Case of Nanocrystalline Magnesia" *Journal of Physical Chemistry C*,115 (48), , 23929-23935. (6 citations, I.F 4.835, 29/251, Q1).
15. V. Alexandrov^{PD}, T. Y. Shvareva^C, **S. Hayun**^{PD}, M. D. Asta^{PI}, and A. Navrotsky^{PI}, 2011,"Actinide Dioxides in Water: Interactions at the Interface " *Journal of Physical Chemistry Letters* 2(24), 3130-3134. (6 citations, I.F 6.687,21/251, Q1).
16. ***S. Hayun**^{PD} and A. Navrotsky^{PI}, 2012, "Formation Enthalpies and Heat Capacities of Rear Earth Titanates: RE₂TiO₅ (RE = La, Nd and Gd)", *Journal of Solid State Chemistry* -187, 70-74. (2 citations, I.F 2.2, 16/45, Q2).
17. ***T. B. Tran**^{PD}, **S. Hayun**^{PD}, A. Navrotsky^C and R. H. R. Castro^{PI}, 2012 , "Transparent Nanocrystalline Pure and Ca-Doped MgO by Spark Plasma Sintering of Anhydrous Nanoparticles" *Journal of the American Ceramic Society* - 95 (4), 1185–1188. (2 citations, I.F 2.428, 1/25, Q1).
18. ***S. Hayun**^{PD}, T. Tran^{PD}, J. Lian^{PI}, A. F. Fuentes^C, A. Navrotsky^{PI}, 2012, "Energetics of stepwise disordering transformation in pyrochlores, Re₂Ti₂O₇ (Re = Y, Gd and Dy)", *Acta Materialia*- 60(10), 4303-4310. (2 citations, I.F 3.941, 1/75 Q1).
19. ***S. Hayun**^{PI}, V. Paris^C, R. Mitrani^S, M. P. Dariel^{PI}, S. Kalabukhov^C, E. Zaretsky^{PI} and N. Frage^{PI}, 2012 , "Microstructure and mechanical properties of silicon carbide processed by Spark Plasma Sintering (SPS)" *Ceramics International* - 38(8), 6335-6340. (8 citations, I.F 2.086, 3/25 Q1).
20. ***I. Edry**^S, V. Erukhimovitch^C, A. Shoihet^T, Y. Mordekovitz^S, N. Frage^{PI} and **S. Hayun**^{PI}, 2013,"Effect of impurity levels on the structure of solidified aluminum under pulse magneto-oscillation (PMO)" *Journal of Materials Science* - 48(24) – 8438-8442 (1 citations, I.F 2.305, 58/251, Q1).
21. ***N. Frage**^{PI}, **S. Hayun**^{PI}, H. Dilman^C and M. P. Dariel^{PI} , 2014., "Low temperature processing of reaction-bonded boron carbide composites", *Advanced Engineering Materials* 16(6) 797-805 (0 citations, I.F, **1.508**, 113/251, Q2).
22. ***S. Meir**^{PD}, S. Kalabukhov^C and **S. Hayun**^{PI}, 2014,"Low temperature spark plasma sintering of Al₂O₃-TiC composites", *Ceramics International*, 40(8A) 12187-12192 (0 citations, I.F 2.086, 3/25 Q1).
23. ***S. Meir**^{PD}, S. Kalabukhov^C, N. Frage^{PI} and **S. Hayun**^{PI}, 2015," Mechanical Properties of Al₂O₃\Ti Composites Fabricated by Spark Plasma", *Ceramics International*, 41(3B) 4637-4643 (0 citations, I.F 2.086, 3/25 Q1).

24. *V. Erukhimovitch^C, Y. Mordekovitz^S, and **S. Hayun**^{PI}, 2015, "Spectroscopic study of ordering in non- stoichiometric magnesium aluminate spinel", American Mineralogist, <http://dx.doi.org/10.2138/am-2015-5266> (0 citations, I.F 2.059, 8/27 Q2)
25. S. Barzilai^{PI} and **S. Hayun**^{PI}, 2015, "Mechanical alloying and thermal analysis of Ta-Ti alloys" Journal of Materials Science, DOI 10.1007/s10853-015-9240-5 (0 citations, I.F 2.305, 58/251, Q1).

Lectures and Presentations at Meetings and Invited Seminars

(b) Presentation of papers at conferences/meetings(oral or poster)

1. **Invited lecture S. Hayun** – "Influence of external electric field and magnesium aluminate spinel stoichiometry on cation distribution and surface properties" 8th International Conference on High Temperature Capillarity (HTC-2015) May 17-21, 2015 Bad-Herrenalb, Germany
2. **Invited lecture S. Hayun** - "Field assisted sintering of nano ceramic oxides", The 32nd Israel Vacuum Society conference - IVS 2014, Sep. 2014 , Herzliya, israel
3. **Invited lecture S. Hayun** – "Effect of Electric Field on the Disorder-Order Transformation in MgO-Al₂O₃ System", 2014 MRS Spring Meeting & Exhibit San Francisco, California, USA, April 21-25, 2014
4. **Invited lecture S. Hayun** - "The Effect of Magnesium Aluminate Spinel Composition on Consolidation by Spark Plasma Sintering (SPS)", Israel Materials Engineering Conference IMEC 16, Technion, Haifa Israel 23-25 Feb. 2014.
5. **Invited lecture. S. Hayun** - "The Effect of Oxide Non-stoichiometry on the Consolidation Behavior of Nanopowders by Spark Plasma Sintering" Materials Science & Technology 2013 Montreal, QC, Canada Oct. 27-31, 2013
6. **Invited lecture .S. Hayun** - "Experimental assessment of the Surface and Water Adsorption Energetics for nanocrystalline magnesia". Twelfth Israeli - Russian Bi-National Workshop 2013, Jerusalem, Israel July 8-15, 2013
7. **Invited lecture. S. Hayun**, T. Y. Shvareva, A. Navrotsky, "Surface and water adsorption energetics for cerium and thorium dioxides" 7th Conference MMT(Material Technologies and Modeling) Ariel, Israel , August 20-23, 2012
8. T. Mordechai , I. Edry and **S. Hayun**, "The effects of cooling rate and duration of Pulse Magneto Oscillation (PMO) treatment on the solidified structure of aluminum" 8th International Conference on High Temperature Capillarity (HTC-2015) May 17-21, 2015 Bad-Herrenalb, Germany
9. Y. Mordekoviz and **S. Hayun**, "Effect of lithium on the synthesis process and phase stability of non-stoichiometry nano magnesium aluminate spinel" 8th International Conference on High Temperature Capillarity (HTC-2015) May 17-21, 2015 Bad-Herrenalb, Germany
10. E. Oz, H. Dilman, **S. Hayun**, N. Frage, "Low temperature fabrication of the reaction bonded B₄C/Al –Si composites" 8th International Conference on High Temperature Capillarity (HTC-2015) May 17-21, 2015 Bad-Herrenalb, Germany

11. S. Sagi and **S. Hayun**, "Surface and water adsorption enthalpies of Nanoscale Nd doped CeO₂" 8th International Conference on High Temperature Capillarity (HTC-2015) May 17-21, 2015 Bad-Herrenalb, Germany
12. Y. Shoval and **S. Hayun** , "Water adsorption enthalpy of non-stoichiometric magnesium aluminate spinel" 8th International Conference on High Temperature Capillarity (HTC-2015) May 17-21, 2015 Bad-Herrenalb, Germany.
13. *M. Halabi , A. Kohn and **S. Hayun** "Measuring the Space Charge Potential in Granular Magnesium Aluminate Spinel using OffAxis Electron Holography" The 49th Annual Scientific Meeting of ISM (ISM 2015) Bar-Ilan University, Ramat Gan. 17-18 May 2015. **Best poster Prize in Materials Sciences**
14. Y. Mordekovitz and **S. Hayun**, "The effect of lithium on the synthesis and sinterability of nano magnesium aluminate spinel" The 32nd Israel Vacuum Society conference - IVS 2014, Sep. 2014 , Herzliya, israel
15. M.Halabi, V. Ezersky, A. Kohn and **S. Hayun**" ,Distributions of cations and inversion parameter in nonstoichiometric magnesium aluminate spinel characterized by electron energy-loss spectroscopy 118" The International Microscopy Congress (IMC 2014) ,Prague, Czech Republic 7-12 ,Sep. 2014.
16. S. Sagi, and S. Hayun, "Surface and water adsorption enthalpies of nanoscale Nd doped CeO₂" The 32nd Israel Vacuum Society conference - IVS 2014, Sep. 2014 , Herzliya, israel
17. *M. Halabi and **S. Hayun**, "Cations distributions and inversion parameter in the MgOnAl₂O₃ spinel system" The 32nd Israel Vacuum Society conference - IVS 2014, Sep. 2014 , Herzliya, israel – **Best poster award**
18. **S. Hayun**, H. Dilman, E. Oz, M. Dariel, N. Frage "Boron Carbide-aluminum Composites Fabricated by Pressureless Infiltration at Low Temperature " International Conference on Mining, Material and Metallurgical Engineering MMME'14 August 11-12 2014 Prague, Czreh Republic
19. V. Erukhimovitch and **S. Hayun**. "Spectroscopic Study in the MgOnAl₂O₃ System", The 14th International Multidisciplinary Scientific GeoConference & EXPO S G E M, June 17-26, 2014, Albena, Bulgaria.
20. M. Halabi and **S. Hayun** "Cation distribution and inversion parameter of non-stoichiometric magnesium aluminate spinel" ISM 2014 - The 48th annual meeting of the Israel society for microscopy, Weizmann institute of science. Rehovot, Israel, May 13-14th, 2014.
21. Y. Shoval, **S. Hayun** "Water adsorption enthalpy of non-stoichiometric magnesia aluminate spinel", NanoIsrael 2014 , The 4th International Nanotechnology Conference & Exhibition, March 24-25, 2014, David InterContinental Hotel, Tel Aviv, Israel.
22. Y. Mordekovitz, **S. Hayun** "The effect of Lithium on the sinterability of nano magnesium aluminate spinel ", NanoIsrael 2014 , The 4th International Nanotechnology Conference & Exhibition, March 24-25, 2014, David InterContinental Hotel, Tel Aviv, Israel.
23. M. Halabi, **S. Hayun** "Inversion Parameter of Non-stoichiometric Magnesium Aluminate Spinel", NanoIsrael 2014 , The 4th International Nanotechnology Conference & Exhibition, March 24-25, 2014, David InterContinental Hotel, Tel Aviv, Israel.
24. Edry, V. Erukhimovitch, N. Frage and S. Hayun, "Effect of Impurity Levels on the Structure of Solidified Aluminum Under Pulse Magneto-oscillation (PMO)" Israel Materials Engineering Conference IMEC 16, Technion, Haifa Israel 23-25 Feb. 2014.
25. M. Ben-Haroush, S. Haroush, M. Cohen, J. Sprintzin, M. Aizenshtein and **S. Hayun**, "Microstructure and Mechanical Properties of Spark Plasma Sintered

- Aluminum Powders”, Israel Materials Engineering Conference IMEC 16, Technion, Haifa Israel 23-25 Feb. 2014.
26. Gabay, W. Kaplan, N. Frage and **S. Hayun**, “Electromagnetic Field Assisted Sintering of SiC”, Israel Materials Engineering Conference IMEC 16, Technion, Haifa Israel 23-25 Feb. 2014.
 27. E. Oz, H. Dilman, **S. Hayun**, M. Dariel and N. Frage, “Low Temperature Fabrication of the Reaction Bonded B₄C/Al-Si Composites”, Israel Materials Engineering Conference IMEC 16, Technion, Haifa Israel 23-25 Feb. 2014.
 28. S. Meir, S. Kalabuhuv, **S. Hayun**, “Low Temperature Spark Plasma Sintering (SPS) OF Al₂O₃/TiC Based Composite”, Israel Materials Engineering Conference IMEC 16, Technion, Haifa Israel 23-25 Feb. 2014.
 29. S. Meir, M. Bereznitsky, V. Kasiyan, **S. Hayun** and N. Frage, “Pressure Assisted Flash Sintering”, Israel Materials Engineering Conference IMEC 16, Technion, Haifa Israel 23-25 Feb. 2014.
 30. Y. Shoal, **S. Hayun** “The Effect of Magnesia Aluminate Spinel Composition on the Water Adsorption Enthalpy”, Israel Materials Engineering Conference IMEC 16, Technion, Haifa Israel 23-25 Feb. 2014.
 31. Y. Mordekovitz, **S. Hayun** “Sintering of Li-doped Magnesium Aluminate Spinel”, Israel Materials Engineering Conference IMEC 16, Technion, Haifa Israel 23-25 Feb. 2014.
 32. M. Halabi, **S. Hayun** “Inversion Parameter of Non-stoichiometric Magnesium Aluminate Spinel”, Israel Materials Engineering Conference IMEC 16, Technion, Haifa Israel 23-25 Feb. 2014.
 33. T. Mordechai, N. Aharon, A. Shoihet, I. Edry, V. Erukhimovitch and **S. Hayun**, “The Effects of Nucleation Sites and Cooling Rate on the Structure of Aluminum Solidified Under Pulse Magneto Oscillation (PMO)”, Israel Materials Engineering Conference IMEC 16, Technion, Haifa Israel 23-25 Feb. 2014.
 34. M. Ben-Haroush, M. Aizenshtein and **S. Hayun** “Spark Plasma Sintering of Aluminum Powders: Microstructure and Mechanical Properties” LightMAT 2013 - Magnesium, Aluminium, Titanium 3 - 5 September 2013 in Bremen, Germany
 35. V. Erukhimovitch and **S. Hayun** “IR spectroscopic characterization of non-stoichiometric nano MgAl₂O₄ spinels” XV Anniversary Balkan Mineral Processing Congress (BMPC 2013), Bulgaria, June, 12-16, 2013
 36. **S. Hayun**, T. Y. Shvareva, A. Navrotsky “Experimental assessment of surface and water adsorption energetics for cerium and thorium dioxides” 7th International Conference High Temperature Capillarity - Eilat, Israel, 2012
 37. **S. Hayun**, T. Tran, J. Lian, A. Navrotsky “Energetics of stepwise disordering transformation in pyrochlores, RE₂Ti₂O₇ (RE = Y, Gd and Dy)” Israel Materials Engineering Conference - IMEC 15 - Dead Sea, Israel, 2012
 38. **S. Hayun**, V. Paris, R. Mitrani, E. Zaretsky, M. Dariel and N. Frage” Microstructure and mechanical properties, dynamic and static, of siliconcarbide processed by Spark Plasma Sintering (SPS),” Israel Materials Engineering Conference - IMEC 15 - Dead Sea, Israel, 2012
 39. R. H. R. Castro, K. Benthem, T. Tran, A. Navrotsky and **S. Hayun**” Experimental methodologies for assessing the surface energy of highly hygroscopic materials: The case of nanocrystalline magnesia” Materials Science & Technology 2011 Conference & Exhibition, Columbus, Ohio, October 16-20, 2011
 40. T. Y. Shvareva, **S. Hayun**, S. Ushakov and A. Navrotsky “Exploring actinide and cerium dioxide surface energetics: Experimental insight” All-Hands and Science Advisory Board Meeting of the Materials Science of Actinides, EFRC. Notre Dame, IN, United States September 24, 2011.

41. T. Y. Shvareva, T. J. Park, **S. Hayun** S. V. Ushakov, A. Navrotsky "Surface and water adsorption energetics of actinide and cerium oxides with fluorite structure 241st ACS National Meeting & Exposition - Anaheim, CA, United States, Abstracts of papers of the American Chemical Society Volume: 241 Meeting Abstract: 96-NUCL
42. S. Barzilai, H. Nagar, M. Aizenshtein, **S. Hayun**, N. Froumin "Wetting and interface interaction between thermodynamically stable oxides and Al containing melts" 6th International Conference High Temperature Capillarity, Athens, Greece. 2009
43. **S. Hayun**, V. Paris, M. P. Dariel, E. Zaretsky and N. Frage, "On The Compressive and Tensile Strength of Magnesium Aluminate Spinel", Spinel -16th APS Topical Conference on Shock Compression of Condensed Matter, APS SCCM - Nashville, Tennessee, USA, 2009
44. **S. Hayun**, M. P. Dariel, and N. Frage "Effect of the Carbon Source on the Microstructure and Mechanical Properties of Reaction Bonded Boron Carbide" - Sintering 2008 - La Jolla (San Diego), Ca. USA
45. **S. Hayun**, A. Weizmann, H. Dilman, M. P. Dariel and N. Frage "Rim region growth and its composition in reaction bonded boron carbide composites with core-rim structure", 16th International Symposium on Boron, Borides and Related Materials Matsue, Shimane, Japan 2008
46. Weizman, **S. Hayun**, H. Dilman, M. P. Dariel, N. Frage "Microstructural evolution of reaction bonded boron carbide composites E-MRS Fall Meeting 2008 Warsaw University of Technology Poland
47. **S. Hayun**, M. P. Dariel and N. Frage, "Microstructure and properties of boron carbide processed by FAST (Field Assisted Sintering Technology)" Advanced Processing of Novel Functional Materials - APNFM 2008 Dresden, Germany,
48. **S. Hayun**, M. P. Dariel and N. Frage, "The Effect of Carbon Source on the Microstructure and Mechanical Properties of Si Infiltrated Boron Carbide Composite- Israel Materials Engineering Conference IMEC XIII, Technion, Haifa Israel Dec. 2007.
49. **S. Hayun**, M. P. Dariel and N. Frage and E. Zaretsky "Mechanical Properties of B₄C Based Si Infiltrated Composites at Various Strain Rate - Israel Materials Engineering Conference- IMEC XIII, Technion, Haifa Israel Dec. 2007.
50. **S. Hayun**, N. Frage, M. P. Dariel and E. Zaretsky "Dynamic Mechanical Behaviour of Boron Carbide Based Composite." 15th APS Topical Conference on Shock Compression of Condensed Matter, APS SCCM Hawaii, USA, 2007
51. N. Frage, **S. Hayun**, S. Kalabukhov, M.P. Dariel "The effect of Fe addition on densification of B₄C powder by spark plasma sintering (SPS)" International Conference HighMatTech, Kiev, Ukraine Oct. 2007.
52. **S. Hayun**, N. Frage, M. P. Dariel "The Morphology of Ceramic Phases in B_xC-SiC-Si Infiltrated Composites., Israel Materials Engineering Conference - IMEC XII, Beer-Sheva, Israel, March 2006.
53. **S. Hayun**, N. Frage, M. P. Dariel "Synthesis of Dense B₄C-SiC-TiB₂ Composites, Israel Materials Engineering Conference - IMEC XII, Beer-Sheva, Israel, March 2006.
54. **S. Hayun**, N. Frage, M. P. Dariel and E. Zaretsky "Dynamic Response of B₄C-SiC Ceramic Composites Israel Materials Engineering Conference - IMEC XII, Beer-Sheva, Israel, March 2006.
55. **S. Hayun**, N. Frage, M. P. Dariel "The morphology of ceramic phases in B_xC-SiC-Si infiltrated composites 15th International Symposium on Boron, Borides, and Related Compounds, Hamburg, Germany, Aug. 2005.
56. **S. Hayun**, N. Frage H. Dilman, V. Tourbabin, M. P. Dariel "Dense B₄C-SiC-TiB₂ composites International Conference HighMatTech, Kiev, Ukraine 2005.

57. **S. Hayun**, N. Frage H. Dilman, V. Tourbabin, M. P. Dariel “Low temperature synthesis of dense B₄C-SiC-TiB₂ composites-The American Ceramic Society, Annual Meeting 2005, Baltimore, Maryland, USA, April, 2005
58. **S. Hayun**, N. Frage, M. P. Dariel, E. Zaretsky, Y. Ashuah, “ Dynamic response of B₄C-SiC ceramic composites-The American Ceramic Society, Annual Meeting 2005, Baltimore, Maryland, USA, April, 2005.

(c)Presentations at informal international seminars and workshops

Thermochemistry, University of California, Davis, USA 2012

(d)Seminar presentations at universities and institutions

1. 2008, Peter A Rock Thermochemistry Laboratory and NEAT ORU - University of California, Davis , USA, “*The inter-relationship between the mechanical properties (static and dynamic) and the microstructure of reaction bonded boron carbide composites*”
2. 2012, Department of Materials Science, Ben Gurion University of the Negev, Israel, “*Experimental Methodologies for Assessing the Water Adsorption Effect on the Surface Energy in Nanoceramics*”
3. 2013, Department of Materials Science & Engineering - Technion, Israel, “*Thermo and defect chemistry of nano oxide powders and their SPS consolidation*”
4. 2014, Department of Mechanical Engineering, Colorado State University, USA,” *Effect of Electric Field on the Disorder-Order Transformation in MgO-Al₂O₃ System*“
5. 2014, Peter A Rock Thermochemistry Laboratory and NEAT ORU - University of California, Davis ,USA,”*Effect of Electric Field on the Disorder-Order Transformation in MgO-Al₂O₃ System*“

Research Grants

1. 2011-2013 - **BSF- S. Hayun (PI)** and A. Navrotsky (PI), “How to retain nanostructure during ceramic sintering: New approach to advanced understanding.” Annual amount: 37,500 \$, Total amount 75,000 \$.
2. 2011-2015 – PAZI foundation - **S. Hayun (PI)**, N. Frage (PI) and Nissim Navi (PI) “Grain refinement by current pulsing”, Annual amount: 33,750 \$, Total amount 135,000 \$
3. 2012-2015 - Israel Ministry of Defense (MAFAT) - **S. Hayun (PI)**, N. Frage (PI) and M. Dariel (PI), Metal matrix composite, Annual amount: 128,000\$, Total amount 386,000 \$
4. 2012-2016 - Marie Curie Career Integration Grants (CIG)- **S. Hayun (PI)**, ”Effect of an External Electric Field on Grain Boundary Evolution in the Course of Nano-Ceramic Sintering”, Annual amount: 31,000\$, Total amount 124,000 \$

5. 2012-2016 - PAZI foundation - **S. Hayun (PI)** and M. Aizenshtein(PI)" Properties of reinforced Al and metals manufactured by powder metallurgy technique, Annual amount: 33,750 \$, Total amount 135,000 \$
6. 2014-2016 – Israel Ministry of Economy- **S. Hayun (PI)**, N. Frage (PI)" Development of advanced ceramic material and technological industrialization of reaction bonding with improved performance for advanced applications", Annual amount: 128,000\$, Total amount 320,000 \$
7. 2014-2017 - International copartion NRCN – JRC "S. Hayun (PI) and S. Zalkind (PI)" The interaction of simple gases (H₂O, H₂, O₂) with actinides (UO₂, CeO₂ and ThO₂) Annual amount: 35,000 \$, Total amount 140,000 \$

Present Academic Activities

Articles to be published

In preparation:

1. M. Halabi and S. Hayun "Inversion Parameter of Non-stoichiometric Magnesium Aluminate Spinel"
2. Y. Shoal and S. Hayun "The Effect of Magnesia Aluminate Spinel Composition on the Water Adsorption Enthalpy".
3. Y. Mordekovitz and S. Hayun "Sintering of Li-doped Magnesium Aluminate Spinel".

Submitted for publication (indicate journal)

1. M. Ben-Haroush^C, G. Dikovskiy^S, S. Kalabuhov^C, M. Aizenshtein^{PI} and S. Hayun^{PI} "The effects of MgO and heat treatment on the mechanical properties and microstructure of spark plasma sintered aluminum" Metallurgical and Materials Transactions, 2015
2. S. Sagi and S. Hayun "Heat capacity of Nd-doped YAG (Y₃Al₅O₁₂) from 300 to 1623 K, Journal of American ceramic society, 2015
3. S. Hayun, S. Meir, S. Kalabukhov, N. Frage and E. Zaretsky, "Phase Constitution and Dynamic Properties of Spark Plasma-Sintered Alumina-Titanium Composites", Journal of American ceramic society, 2015

Synopsis of research, including reference to publications and grants in above listsHow to retain nanostructure during ceramic sintering: New approach for advanced understanding.

Nano-ceramics have an important place in modern technology and industry. Despite their widespread use, the technology for preserving the nanostructure throughout the processing stages, particularly sintering at high temperatures, is still not firmly established. Although the principles for sintering of nanoparticles are the same as those for coarser particles, a number of issues and challenges that are specific to nano-sintering remain to be addressed, as follows:

The total interfacial free energy, which is the driving force for the process, is large, making it difficult to control the process. The atomic structural state in the nano domain, especially in complex oxides, is usually not in thermodynamic equilibrium. In the consolidation of oxide nanoparticles, the application of an electric field/current has been under development as a promising new route for retaining the nanostructure in the bulk. However, the presence of an electric field/current during sintering has raised new fundamental questions as to how the basic defect chemistry and the thermochemistry (interfacial energies) are influenced by the electric field at high temperatures. In preliminary studies [BSF grant], on sintering of nano MgAl_2O_4 by the spark plasma sintering technology (i.e., sintering in the presence of an electric field), we have found that this technology helps to preserve the grains at the nano scale ($\langle D \rangle \sim 80$ nm) in the bulk, and that it promotes structural changes at the atomic scale (i.e., disorder to order transformation). The overall objective of this research is to reveal the impact of a DC electrical field on the defect chemistry and thermochemistry of grain boundaries in ionic oxide ceramics during sintering. We hypothesize that the interaction between the electric field and the intrinsic and imposed structural defects will affect the sintering mechanism. The significance of our studies stems from its potential to identify the effects of an electric field on the interfacial energy, on the chemistry and physical and mechanical properties of the ceramics, and finally on their resulting microstructures. The results are meant to establish the role of the electric field during sintering, and thereby to provide novel means for maintaining the structure and properties of nano-ceramics.

This research is carried out within the framework of grants No. 1 and 4, Relevant Ref. 1-8

Metal-ceramic composites. Processing, microstructure and properties (in collaboration with Prof. M.P. Dariel and Prof. N. Frage)

The basic concept of combining metal and ceramic on an intimate scale is incorporation of the desirable qualities of either species and suppression of the undesirable properties. The cermets that we are studying can be divided in two classes: light metal-ceramic composites ($\text{B}_4\text{C-Al}$, $\text{B}_4\text{C-Si}$, $\text{TiB}_2\text{-Al}$, TiC-Al) and relatively heavy metal-ceramic composites ($\text{B}_4\text{C-Fe}$, TiC-Ni , $\text{TiC-TiB}_2\text{-Ni}$, TiC-Steels). These composites have a very high hardness and improved fracture toughness compared with the ceramic materials and are very attractive materials for armor applications. Considerable progress was made towards production of acceptable metal-ceramic composites based on the boron carbide infiltrated with silicon. These composites display some unique characteristic as armor materials. The results concerning the $\text{B}_4\text{C-Si}$ composites were published in 8 papers and were presented at more than 7 international conferences. In the last 2 years the further development of the metal-ceramic composites was achieved by applying the concept of Functionally Graded Material (FGM). The FGM concept provides additional degrees of freedom for designers of material systems and illustrates the modern tendency to custom-design materials for specific applications. According to this concept, several original approaches for production of

composites with a gradual change of the metal-to-ceramic ratio were suggested and applied for the $\text{Al}_2\text{O}_3\text{-Ni}$ and $\text{Al}_2\text{O}_3\text{-Ti}$ systems. The research is in progress.

This research is being carried out within the framework of grant No. 3, Relevant Ref. 9-17, 19 and 21-23

Grain refinement by current pulsing

The influence of the electromagnetic pulse (EMP) treatments (electric current pulsing- ECP, pulse magnetic field- PMF or pulse magneto oscillation- PMO) on the solidified structure of alloys or pure metals has been well demonstrated. The main result of EMP treatment on the solidified microstructure is the transformation from coarse columnar grains to fine globular microstructure. It may be explained by the appearance of a large amount of nucleation sites in the melt bulk which suppress the dendrites growth from the mold walls. For the explanation of this phenomenon several models were proposed: the thermodynamic model (i.e. based on the bulk melt free-energy change in the course of nuclei formation under current density flow) and the crystal rain model, here the magnetic pressure promotes crystal spreading and creates numerous sites for nucleation. All the proposed models explain some of the processes characteristics, however a whole description of the obtained experimental data is still lacking. In the current research, we aim to develop a model which will clarify, hopefully this phenomenon.

This research is being conducted within the framework of grant No. 2. Ref. 20