TALI BAR-KOHANY, Ph.D.

Curriculum vitae

2018

Personal Details

Name:	Tali Bar (-Kohany)
Date & Place of birth:	July 21, 1973, Beer-Sheva, ISRAEL
Cell.:	+972-50-6248918;
Email:	talibk@tauex.tau.ac.il

Education

Ben-Gurion University of the Negev, Department of Mechanical Engineering

Ph.D.	2000 - 2004	A Study of the Mechanism of Sprays Formation by Bi-Component Liquid Flashing
M.Sc.	1998 - 2000	Strategic Analysis of Variable Valve Timing in SI Engines
B.Sc. *with honors*	1994 - 1998	Thermodynamical Analysis of a Practical Otto Cycle with Entropy and Availability
VKI, Belgium	23-27/1 /2006	Introduction to CFD, Von-Karman Institute for Fluid Dynamics
CISM, Italy	10-14/7 /2000	Interfacial Phenomena, The Marangoni Effect, Instability, Waves and Convective Flows, International Center for Mechanical Science

Awards& Fellowship

2016	1st prize for presented poster at the 30th Annual Symposium of the Israeli Section of the Combustion Institute
2010	Honorary Fellow, Australian Institute of High Energetic Materials
2004 - 2010	Katzir Scholarships Program – Ministry of Defense
2002	1st prize for presented poster at the 18th Annual Symposium of the Israeli Section of the Combustion Institute.
2001	Major Ehud Ben-Amitai Scholarships Fund for Aeronautic research
2000	WOLF award for Outstanding Master achievements
1998	Head of Department award for excellence

Relevant Experience

WORK EXPERIENCE

8/2017 – 8/2018	***Visiting faculty & External Lecturer*** University of Maryland, College Park Department of Mechanical Engineering
10/2015 - present	***Visiting faculty*** Tel-Aviv University School of Mechanical Engineering
8/2013 – 8/2014	***Visiting faculty*** University of California, Irvine Department of Mechanical Engineering
2004 - present	***Senior Researcher*** Nuclear Research Center of the Negev 2004 -2007: Physics Department 2007 – present: R&D Engineering Department Senior researcher: Two-phase & reactive flow, Phase change, Fluid Dynamics, Vacuum.
2008-2017	***Lecturer, External*** Ben-Gurion University of the Negev First Course of Thermodynamics - Mechanical, Energy & Biotechnology Engineering. Principles in Combustion – Safety and Management Engineering.
1998 – 2004	***Teaching Assistant*** Department of Mechanical Engineering, BGU Frontal and Lab instruction in the courses of Thermodynamics, Heat Transfer and Fluid Mechanics.

COURSESTAUGHT

2017	*Lecturer* Department of Mechanical Engineering, UMD Fluid Mechanics
2015-2017	*Lecturer* Energy Engineering Unit, BGU Introduction to energy engineering – Thermodynamics
2014	*Lecturer* Department of Biotechnology Engineering, BGU First course of Thermodynamics
2012–present	*Lecturer* Management and Safety Engineering Unit for Graduate studies, BGU, Principles of Combustion processes
2012	*Lecturer* Department of Mechanical Engineering, SCE First course of Heat transfer
2012	***Lecturer, Developed syllabus and overall course structure*** Australian Institute of High Energetic Materials, Two-Phase & Choked Flows and Their Application in Spray Systems
2008 - 2010	*Lecturer* Department of Mechanical Engineering, BGU First course of Thermodynamics
2004 – 2008	*Guest Lecturer* Department of Materials Engineering, BGU Fundamentals of Leak Testing, for the course of Non-Destructive Evaluation
2002 - 2004	***Lecturer, Developed syllabus and overall course structure*** BGU School of Continued Education Physical Fundamentals of Mechanical Engineering

STUDENTS

2018-present **Amiav Lankri**, M.Sc. in Mechanical Engineering BGU,
Nucleation inception temperature in boiling due to rapid heating under various thermodynamic conditions.

2016-present **Amir Shalel**, M.Sc. in Safety and Management Engineering BGU,
Optimization of extinguishing powder dispersal.
supervision with Prof. David Katoshevski

2016-present **LiorNahon**, M.Sc. in Energy Engineering BGU
Countercurrent limited critical heat flux with heat transfer to the wall.
supervision with Dr. Yosef Aharon

2016-2019 **Yarden Amsalem**, M.Sc. in Mechanical Engineering TAU
Cubic Equations of State and nucleation inception in boiling due to rapid heating.

2016-2018 **Yaniv Levin**, M.Sc. Project in Mechanical Engineering TAU
Modelling and simulating Ozonationof Lignocellulosic Biomass.
Supervision with Prof. Hadas Mamane.

2014-2016 **Tal Eluk**, M.Sc. in Mechanical Engineering BGU
Two-phase reactive flow; CFD-DPM model of combustion process in a co-current gas-solid reactor.
supervision with Prof. Avi Levy

2011 – 2015 **Naor Hayun**, M.Sc. in Mechanical Engineering BGU
Temperature profile control as a tool to improve chemical reaction in gas-particle downer.
supervision with Prof. Avi Levy

2013 – 2014 **Idan Cohen**, M.Sc. in Mechanical Engineering, BGU
Study of the thermal behavior of a thermo-luminescence detector (TLD) due to gas heating.
supervision with Prof. Gennady Ziskind

2010 – 2012 **Kobi Dahan**, M.Sc. in Mechanical Engineering, BGU
Gas leakage and flammability into enclosures.

2009 – 2011 **Ravit Rozenfeld**, M.Sc. in Mechanical Engineering, BGU
Study of the thermal behavior of a thermo-luminescence detector (TLD) due to gas heating.
supervision with Prof. Gennady Ziskind

Scientific Publications

Journal Papers

H-index: 7; i10-index: 7; Total citations: 400 ;https://scholar.google.com/citations?user=QEXmTrTRGVQC&hl=en

1. Arogeti, M., Sher, E., and **Bar-Kohany, T.**, (2019), "Drop impact on small targets with different target-to-drop diameters ratio", *Chemical Engineering Science*, Vol. 193, pp.89-101.

2. **Bar-Kohany, T.** and Amsalem, Y., (2018), "Nucleation temperature under various heating rates", *International Journal of Heat and Mass Transfer*, Vol. 126, pp. 411-415[1].

3. Dagan, Y. and **Bar-Kohany, T., (2018), "**Flame propagation through three-phase methane-hydrate particles", *Combustion and Flames,* Vol. 193, pp.25-35[1].

4. Arogeti, M., Sher, E. and **Bar-Kohany, T., (2017), "**A single drop impact on a flat, dry surface – A unified correlation", *Atomization and Sprays*, Vol.27(9), pp.759-770.

5. Eluk, T., Levy, A., Korytnyi, E. and **Bar-Kohany, T**., (2017) "Transition Mechanism between combustion regions in swirling flow in downer reactors", *Energy and Fuels,* Vol.31(2),pp.1927-1934.

6. **Bar-Kohany, T.** and Levy, M., (2016), "State of the art review of flash boiling atomization", *Atomization and Sprays,* Vol. 26(12), pp. 1259-1305.

7. **Bar-Kohany, T**. and Sirignano, W.A., (2016), "Transient combustion of a methane-hydrate sphere", *Combustion and Flames,* Vol.163, pp.284-300[1].

8. Cohen, I., **Bar-Kohany, T**., German, U. and Ziskind, G., (2014), "Optimization of the temperature profiles due to a nitrogen jet impinging on a TLD detector", *Radiation and Measurements,* Vol.70, pp. 48-51.

9. Sher, E., Sher, I. and **Bar-Kohany, T.,** (2013), "Another view of the upper and intermediate explosion limits of a H_2-O_2 system.", *Elsevier, International Journal of Hydrogen Energy 38, pp.14912-14914, 2013*

10. **Bar-Kohany, T.** and Dahan, K., (2012), "Evaluation of the one-step hydrogen-oxygen global reaction rate in a non-premixed mixture to predict auto-ignition limits", *International Journal of Hydrogen Energy,* Vol.37(19), pp.14669-14675.

11. **Bar-Kohany, T.** and Stern, A., (2011), "Prediction of Container Hermeticity for Isostatic Pressuring Process", *ResearchBulleting of the Australian Institute of High Energetic Materials,* Vol.1, pp.10-27.

[1] Sabbatical

12. **Bar-Kohany, T.,** Rozenfeld, R., Weinstein, M., Abraham, A., German, U., Alfassi, Z.B. and Ziskind, G., (2011), "Thermal Behavior of a LiF Crystal Mounted in a TLD Card and Heated by Jet Impingement", *Radiation and Measurements*, Vol.46(12), pp.1432-1435.

13. Sher, E. ,**Bar-Kohany, T**. and Rashkovan, A., (2008), "Flash Boiling Atomization", ***Invited Review***, *Progress in Energy and Combustion Science* (*PECS*), Vol.34(4), pp.417.

14. **Bar-Kohany, T.,** I. Sher and E. Sher, (2007), "Choked Flow of a Two-Phase Mixture Through and Aperture: a Theoretical Approach", *Atomization and Spray's*, Vol.17(5), pp.431-449.

15. **Bar-Kohany, T.** and Stern, A., (2007), "Lifetime Estimation of MOEMS Devices", *Journal of Electronic Packaging*, Vol.129, pp.144-148.

16. **Bar-Kohany, T.** and E. Sher,(2004), "Effervescent Atomization Under Sub-sonic and Choked Conditions – a Theoretical Approach", *Chem. Eng. Sci.*, Vol. 59, pp.5987-5995.

17. **Bar-Kohany, T.** and E. Sher,(2004), "Subsonic Atomization Effervescent: a Theoretical Approach", *Atomization and Sprays*, Vol. 14(6), pp.495-509.

18. **Bar-Kohany, T.** and E. Sher, (2002), "Optimization of Variable Valve Timing for Maximizing Performance of an Unthrottled SI Engine – a Theoretical Study", *Energy*, Vol. 27, pp.757-775.

19. **Bar-Kohany, T.** and E. Sher, (1999), "Using the 2nd Law of Thermodynamics to Optimize Variable Valve Timing for Maximizing Torque in a Throttled SI Engine", *SAE Technical Papers*, 1999-01-0328.

Conference papers

International Conferences

1. Nahon, L., **Bar-Kohany, T**., Rabinovich, E., and Aharon, Y., "Critical heat flux in cerical annulus under zero flow conditions with radial heat losses", NURETH, USA.

2. [2]**Bar-Kohany, T**., Haustein, H.D., and Elias, E., "Lifetime of a tensioned liquid following a depressurization impulse", 14th ICLASS, July 22-26, Chicago, USA, 2018[1].

3. **Bar-Kohany, T**., and Dagan, Y., "Evaporation and combustion of spray consisting of three-phase methane-hydrate particles", 14th ICLASS, July 22-26, Chicago, USA, 2018[2].

[2] **Session Chair & Lecturer**

4. [3]**Bar-Kohany, T.**, "Combustion of three-phase methane-hydrate spheres", Joint aerospace and fluid dynamics reviews seminars, University of Maryland, College Park, 2018[2].

5. **Bar-Kohany, T.**, Presentation for holding the 2020 ILASS conference in Israel, 28th ILASS-Europe, Valencia, Spain, 2017[2].

6. Shalel A., **Bar-Kohany, T.** and Katoshevski, D., "Optimization of Extinguishing Powder dispersal", IAAR, Technion, Israel, 2016.

7. [2]**Bar-Kohany, T.**,Sirignano, W.A., "Combustion of a methane-hydrate particle", *27th ILASS*, September, 4-7, 2016, Brighton, UK.

8. **Bar-Kohany, T.**, "Mechanism of spray formation by bi-component liquid flashing", *TAU-UMD joint workshop on single and multiphase heat transfer*, July, 25-29, Tel-Aviv, 2016.

9. Eluk, T.,Korytnyi, E., Levy, A. and **Bar-Kohany, T**, "Transition between robust equilibrium design points for multiphase combustion in downers", *9th International conference on multiphase flow*, May, 22-27, 2016, Firenze, Italy.

10. Eluk, T., **Bar-Kohany, T.**, Korytnyi, E., and Levy, A., "Pulverized coal combustion modelling for downer type reactors", *8th International conference for conveying and handling of particulate solids*, May 2015, Tel-Aviv, Israel.

11. **Bar-Kohany, T.** and Dahan, K., "Hydrogen Release, Dispersion and Auto-Ignition In Enclosures", *7th Mediterranean Combustion Science (MCS)*, September 11-15, 2011, Sardinia, Italy.

12. **Bar-Kohany, T.** and E. Sher, "Critical Discharge from Flash Boiling Atomizer", *10th Joint European Thermodynamic Conference (JETC)*, June 22-24, 2009, Copenhagen, Denmark.

13. **Bar-Kohany, T.** and E. Sher, "Spray Formation by Bi-Component Liquid Flashing Under Sub- and Choked Conditions", *ICHMT*, June5-10, 2005, Antalya, Turkey.

14. A. Stern, M. Kemelman, **T. Bar-Kohany**, and K. Feldman, "Hermetic Encapsulation of MOEMS by Fluxless Soldering", *Welding and Joining*, January 25-28, 2005, Tel-Aviv, Israel

15. K. Feldman, **T. Bar-Kohany** and A. Stern, "Detection of Fine Leaks in MOEM Hermetic Sealed Cavities", *Welding and Joining*, January 25-28, 2005, Tel-Aviv, Israel.

16. **Bar-Kohany**, T. and E. Sher, "Spray Formation by Bi-Component Liquid Flashing Under Sub- and Choked Conditions: a Theoretical Approach", *ILASS-EUROPE*, September 6-8, 2004, Nottingham, UK.

17. **Bar-Kohany**, T. and E. Sher, "Spray Formation by Bi-Component Liquid Flashing: a Theoretical Approach", *ILASS-EUROPE*, September 9-11, 2002, Zaragoza, Spain.

[3] **Invited lecture**

18. **Bar-Kohany, T.** and E. Sher, "Nucleation – Theory and Reality", Bi-National Israel-Britain *Workshop on Applied Mathematical Methods in Spray Combustion*, 2001, Beer-Sheva, Israel.

19. **Bar-Kohany, T**. and E. Sher, "Using the 2nd Law of Thermodynamics to Optimize Variable Valve Timing for Maximizing Torque in a Throttled SI Engine", *SAE International*, March 1-4, 1999, Detroit, Canada.

National Conferences

20. **Bar-Kohany, T.,** and Dagan, Y., "Combustion of spray consisting of three-phase particles", 32th Annual Symposium of the Israeli Section of the Combustion institute (ISC-32), December, 2018, Tel-Aviv, Israel.

21. Amsalem, Y., and **Bar-Kohany, T.,** "Combustion of spray consisting of three-phase particles", 35th Israeli Conference of Mechanical Engineering (ICME-35), 9-10 October, 2018, Ben-Gurion University, Israel.

22. Shalel, A., **Bar-Kohany, T.,** and Katoshevski, D., (2017), "Optimization of extinguishing powder dispersal", The 27th Annual meeting of the Israeli Association of Aerosol Research (IAAR-27), March 13, Technion, Israel.

23. **Bar-Kohany, T.,** "Depressurization of liquid to low or negative pressure; What is it good for?", 34th Israeli Conference of Mechanical Engineering (ICME-34), 21-22 November, 2016, Technion, Israel.[4]

24. Eluk, T., Levy, A., Kortnyi, E., and **Bar-Kohany, T.,** "Controlling robust design points for gas-solid combustion in co-current reactors", 34th Israeli Conference of Mechanical Engineering (ICME-34), 21-22 November, 2016, Technion, Israel.4

25. Eluk, T., Levy, A., Kortnyi, E., and **Bar-Kohany, T.,** "Transition between robust equilibrium design points for gas-solid combustion on co-current reactors", 40th Symposium on computational mechanics (ISCM-40), April, 7, 2016, Tel-Aviv University, Israel

26. **Bar-Kohany, T.,** and Aharon, Y., "Characteristic times and fuel response to a sudden increase in core reactivity", 28th Conference of Nuclear societies in Israel, 12-14, October, 2016 Dead-Sea, Israel.

27. Dahan, K., and **Bar-Kohany, T.,** "", 33th Israeli Conference of Mechanical Engineering (ICME-33), 2015, Technion, Israel.

28. Cohen, I., German, U., Ziskind, G., and **Bar-Kohany, T.,** "Parametric analysis of temperature profiles due to a nitrogen jet impinging on a TL Detector", 33th Israeli Conference of Mechanical Engineering (ICME-33), 2015, Technion, Israel.

[4] **Session chair & Lecturer**

29. **Bar-Kohany, T.,** and Sirignano, W.A., "Combustion of a methane-hydrate particle", 28th Annual Symposium of the Israeli Section of the Combustion Institute, December, 2014, Tel-Aviv, Israel

30. Cohen, I., German, U., Ziskind, G., and **Bar-Kohany, T.,** "Aanalysis of temperature profiles due to a nitrogen jet impinging on a TLD", 26th Annual Symposium of the Israeli Section of the Combustion Institute, 21-23 February, 2012, Tel-Aviv, Israel

31. Rozenfeld, R., **Bar-Kohany, T.,** Weinstein, M., Abraham, A., German, U., Alfassi, Z.B. and Ziskind, G., "Study of thermal behavior of a TLD detector due to heating by Jet impingement", *The 26th Conference of the Nuclear Societies in Israel*, February, 2012, Dead-Sea, Israel

32. Rozenfeld, R., **Bar-Kohany, T.,** Weinstein, M., Abraham, A., German, U., Alfassi, Z.B. and Ziskind, G., "Thermal Behavior of a TLD Detector Due to Heating by Jet Impingement", *The 25th Conference of the Nuclear Societies in Israel*, February, 2010, Dead-Sea, Israel

33. **Bar-Kohany, T.** and Sher, E., "Author look into the 3 Explosion Limits", *24th Annual Symposium of the Israel Section of the Combustion Institute*, December, 2009, Tel-Aviv, Israel

34. **Bar-Kohany T.,** Feldman, K. and A. Stern, "Optical Micro-electro-mechanical Systems – Wafer Level Encapsulation",*The 12th Israeli Materials Engineering Conference*, March 2006, Tel-Aviv, Israel.

35. **Bar-Kohany T.** and A. Stern, "Leak Testing of MOEMS – Theory and Practice", 30th Israel Conference on Mechanical Engineering, May 29-30, 2005, Tel-Aviv, Israel.

36. Sher, E., Rashkovan, A. and **Bar-Kohany, T.**, "Effervescent Spray", *21th Annual Symposium of the Israel Section of the Combustion Institute*, December, 2005, Technion, Haifa, Israel

37. **Bar-Kohany, T.** and E. Sher, "A Study of the Mechanism of Sprays Formation by Bi-component Liquid Flashing", *30th Israel Conference on Mechanical Engineering*, May 29-30, 2005, Tel-Aviv, Israel

38. **Bar-Kohany, T.** and E. Sher, "Spray Formation by Bi-Component Liquid Flashing: a Theoretical Approach", *20th Israeli Conference on Combustion*, Beer-Sheva, Israel, December 9, 2004.

39. **Bar-Kohany T.** and A. Stern, "Hermeticity Tests of Sealed Cavities", *ASNT*-Israel, July 14, 2004.

40. **Bar-Kohany T.** and A. Stern, "Non-Destructive Leak Tests in Hermetic Sealed Cavities – Practical and Theoretical Considerations", *ISME*- Israel National Conference on Welding, March, 2004.

41. **Bar-Kohany, T.** and E. Sher, "A Study of Spray Formation by Bi-component Liquid Flashing", *29th Israel Conference on Mechanical Engineering*, May 12-13, 2003, Haifa, Israel

42. **Bar-Kohany, T.** and E. Sher, "Variable Valve Timing for Gasoline Engines", *28th Israel Conference on Mechanical Engineering*, June 14-15, 2000, Beer-Sheva, Israel

Additional Professional Activities

Positions in academic administration

1. Co-Chair of the upcoming 2020 ILASS international conference that will be held in Israel.
2. 2016, M.Sc. Judging committee of Ms. Maayan Friman-Peretz, BGU, Mechanical engineering,
3. 2016, M.Sc. Judging committee of Ms. Nerdit Aslanov, BGU, Mechanical engineering,
4. 2012, M.Sc. Judging committee of Ms. Liran Fanny Haim, BGU, Mechanical engineering,

Significant professional consulting

2014, Therm-Sphera, Thermodynamic process optimization.

Ad-hoc reviewer for journals (by alphabetic order)

1. AS - Atomization and Sprays, Begell House Inc.
2. ChES - Chemical Review Engineering
3. Energies
4. FE - Fluids Engineering
5. IJHE - International Journal of Hydrogen Energy
6. IJMF - International Journal of Multiphase Flow
7. JHT - Journal of Heat Transfer
8. Molecules
9. Scientific Reports – Nature group

Research grants

2016-2020, **Bar-Kohany^{PI}, T.**Haustein^{PI}, H. and Elias^{PI}, E., Council of higher education (VATAT), Title: "Non-equilibrium aspects of boiling related to safety scenarios in nuclear reactors", annual: 100k$, total: 400k$.

2012-2016, **Bar-Kohany^{PI}, T.** and Levy^{PI}, A., Council of higher education (VATAT), Title: "Co-current gas-solid reactive flow in a downer flame reactor", annual: 57 k$, total: 228 k$.

Selected publications

Arogeti, M. and Bar-Kohany, T., (2019), "Drop impact on small targets with different target-to-drop diameters ratio", ***Chemical Engineering Science,*** **Vol. 193, pp. 89-101.**

Drop impact of a drop onto a solid surface can deposit, bound or splash. In the current paper we were concerned with the deposition phenomenon. The deposition process is an important one in various industrial processes as spray coating, cooling, pesticide, printing, etc.

The impact outcome depends both on the drop and on the surface characteristics.

A target is considered small when the characteristic dimension of the surface is not infinitely large as compared to the characteristic dimension of the drop. In these cases, the ratio between these dimensions, usually the target-to-drop diameter ratio ($\beta_t \equiv D_t/D_0$), is important.

One of the most important parameters for these applications is the maximal spreading diameter that can be predicted by non-dimensional groups as the Reynolds and the Weber numbers.

In our study, we conducted experiments with small cylindrical targets and water drops. We identified three distinct regions, characterized by the different dynamic response of the drop, as related to the target-to-drop diameter ratio

Type- A: $1 < \beta_t \leq \beta_{max}$; Type- B: $1/2 < \beta_t \leq 1$; Type- C: $\beta_t \leq 1/2$;

For each impact type, we developed an analytical expression with which the maximal spreading diameter can be predicted.

Personal contribution to the paper

The study was conducted within the framework of the dissertation of Dr. Merav Arogeti, who conducted the experimental results. I joined Professor Eran Sher in advising Dr. Arogeti in her dissertation once the experiments where completed. Together we developed the analytical expressions. I mapped the experimental work, both of Merav's and of other studies in the world by an illustrative map, that demonstrated that our work contributes to close the known gap that existed for small targets within the region of $0.345 \leq \beta_t \leq 4.5$. Moreover, it pointed out that other gaps are still to be filled for intermediate and high Weber numbers.

Amsalem, Y. and Bar-Kohany, T., (2018), "Nucleation temperature under various heating rates", *International Journal of Heat and Mass Transfer,* Vol. 126, pp. 411-415.

Boiling at equilibrium occurs at the saturation temperature at the appropriate pressure; namely at the binodal. However, many phase change processes in nature and at various industrial processes occur due to rapid heating, thus at quasi- or at non-equilibrium thermodynamic conditions. For these conditions, bubble embryos spontaneously grow within the meta-stable liquid; namely within the region that is bounded by the binodal and the spinodal (the later defines the limit of thermodynamic stability). This is a well known and frequent phenomena. Yet, despite its frequent occurrence, the question still arises: what is the degree of penetration into the metastable zone, given initial conditions and a heating rate?

The purpose of this paper is to solve this riddle, at least in a phenomenological way, by developing a simple analytical model through which the above question can be answered.

We propose to include the dynamic effects of the rapid isobaric heating in the heterogeneous factor, by expressing it with two functions, having only a single free parameter.

The functions manifest the inverse proportion of the nucleation inception temperature on the superheating degree, represented by the Jakob number. We have proven that this semi-analytical correlation can be applied for different fluids (polar and non-polar), under heating rates that vary between 10^5 to 10^8 K/s.

Personal contribution to the paper

The fundamental research question that lies at the base of this ongoing research was drawn by me about 15 years ago. However, only recently I actively returned to it. After my decision to reengage with the subject I advised an M.Sc. student (@ Tel-Aviv University) for that. During the past two years my student and I collected relevant data, though it is scarce, which led me to continue the work with another student these days.

After collecting all the available data, to the best of our knowledge, we refined the correlation and tested it on the data that was collected.

Eluk, T., Kortnyi, E., Levy, A. and Bar-Kohany, T., (2017), "Transition mechanism between combustion regions in swirling flow in downer reactors", *Energy and Fuels*, Vol. 31, pp. 1927-1934.

The paper presents a numerical analysis (with Ansys-Fluent) of a combustion process of coal particles in a co-current reactor.

The study aims to investigate transitional behavior of a swirl dominated reactor.

A transition mechanism between two mechanism between two combustion structures was recognized. It was found the NBC regime (Near Burner Combustion) is mainly affected by the hydrodynamics, while the FRC (Far Region Combustion) is mainly affected by the material properties, and especially the devolatilization kinetics. When given the material properties, the transition between these regimes strongly depends on the operating conditions such as particles injection velocity and their size distribution, and the relative and swirl velocity of the gas phase. These, in turn, determine the recirculation degree of the hot gases, and by that determines the transition conditions.

A new methodology for the selection of a distribution representative was presented, which can be applied to other types of multiphase, exothermic reacting flows.

Understanding these mechanisms contributes to a better control over processes, e.g. regarding phase continuous mixing vs. short contact requirements.

Personal contribution to the paper

The research topic was initiated by me, and together with Professor Avi Levy, head of the mechanical department at Ben-Gurion University, we won a Pazy grant. Together we advised Mr. Naor Hayun, that was working with at nrcn, for an M.Sc. degree. After his preliminary work was completed, I have included Dr. Efim Kortbnyi of the laboratory of clean combustion, who was responsible for the experimental data. Together we advised another M.Sc. student, Tal-Eluk, who conducted the full 3D, reactive flow model. During the process I was heavily involved in the reactive flow modeling and analysis.

<u>Bar-Kohany, T</u>. and Sirignano, W.A., (2016), "Transient combustion of a methane-hydrate sphere", *Combustion and Flame*, Vol.163, pp.284-300.

Methane-Hydrates (MH) are ice-like crystalline solids, consisting of non-stoichiometric compounds water cavities and methane gas molecules. The guest molecule (methane) stabilized the hydrogen-bonds of the cavity, thus preventing strain and breakage of the unit cell at high pressure and low temperature levels. Thanks to it, MH can be found as solid at 15°C at pressures as low as 10 atm.

The paper presents a theoretical analysis of evaporation and combustion processes of a small, MH spherical particle. It is postulated that once a MH particle is placed in a hot, quiescent environment, the solid water starts to melt, and a thin spherical shell of bubbly-mixture wraps the icy core. Heat from the environment is conducted through the bubbly-mixture (BM) and into the icy core. Thus, the heat is being used both to melt the icy core, to elevate the bubbly-mixture temperature and to evaporate the water from its surface. During this process the particle consist of three phases, two-components and two interfaces.

With time, the shell thickens, and in contrary to other evaporating particles and models, its outer interface (solid-BM) progresses while its inner interface (BM-gas) continuously retracts. Namely, the outer surface presents a non-linear, and non-monotonic behavior, and this behavior is unique for the MH particles. The bubbly mixture layer was analyzed as a transient problem with two-moving boundaries and included Stefan convection.

The combustion process of the MH particles was considered at infinite chemical reaction rate, at different ambient conditions.

<u>Personal contribution to the paper</u>

Before starting my Sabbatical at the University of California, Irvine, I approached Professor W.A. Sirignano to find an interesting and challenging topic. Professor Sirignano suggested this unique problem, so once I arrived to UCI, I worked with Professor Sirignano to understand and analyze these new and unique processes. Moreover, I developed the numerical code that was used to solve evaporation and combustion models.

Bar-Kohany, T. and Levy, M., (2016), "State of the art review of flash boiling atomization", *Atomization and Sprays,* Vol. 26(12), pp. 1259-1305.

Flash boiling atomization has been gaining popularity for the past few decades as a method of creating fine sprays at relatively low energetic costs.

The present paper aims to review and analyze our current knowledge on flash atomization processes and applications, and is an extension of the previous review that was published in the *Progress in Energy and Combustion Science* on 2008.

First, the fundamental physical processes of flash-boiling atomization, i.e., nucleation and bubble growth. Then, their role in creating optimal spray (small droplet diameters and short breakup length) is analyzed. Special attention is given to reviewing and comparing different transition criteria.

Flashing liquid jets can be classified into three main categories. Transition between these regimes are determined mainly by the level of superheat which sets nucleation regime and bubble growth rate, which are of major influence on the spray quality.

The conclusions can be used by those who aim to avoid accidental scenarios, or, to minimize hazardous scenarios.

It is concluded that flash boiling at higher superheat degrees lead to finer spray for single aperture atomizer. Twin orifice injector with an expansion chamber is preferable for multi-component liquid. The optimal degree is the one that will lead to high nucleation rate, accompanied with the highest slip between the phase that is best achieved by choking of the gaseous phase of the mixture, a theory that was derived by me during my Ph.D.

It was identified that there is a lack in data of depressurization rates and their relation to spray characteristics for different liquids.

Personal contribution to the paper

As flash boiling is one of my major research interests, I initiated the review once I felt that the previous review that I wrote about 10 years ago is lacking of certain information, such an adequate comparison of transition criteria for different spray patterns for different injectors.