

## **Dr. Itzhak Shalev – Curriculum Vitae**

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Dr. Itzhak Shalev holds a Ph.D. in Fiber and Polymer Science from North Carolina State University. He has served as Head of the Department of Industrial Chemistry and as Dean of Student Affairs at Shenkar College, as Chairman of the Israel Textile Association and Visiting Associate Professor at the College of Textiles at NCSU.

Dr. Shalev is currently CTO-Textiles at ThermoSiv and Director at Zzakey Technologies Ltd., a R&D support company. Dr. Shalev is a consultant to the Israeli Ministry of Health and Defense, the Israel Electric Company, Israel Chemical Industries, Teva Pharmaceuticals and numerous other large and small industrial firms and startups in Israel and abroad. He has 40 years of experience in industrial chemicals, formulations and the fiber and polymer-based industries and has published over 80 technical papers and patents. Dr. Shalev is currently active in industrial R&D in the fields of high-performance polymers, chemical processing, formulation development, nonwovens, functional textiles, raw material natural alternatives, fire and NBC protection and medical device technology.

### **Education**

1984 PhD in Fiber Science and Polymer Chemistry. University of North Carolina, USA.

1980 B.Tc in Industrial Chemistry, Shenkar School of Engineering and Design, Ramat Gan

### **Experience**

**2003** - Today CEO of Tzki Technologies Ltd. - Industrial research and development company, technological consulting and professional training

**1998 - 2003** CEO of Arpel Engineering Ltd. - an engineering company for process equipment and industrial production systems.

**1992 - 1998** Planning and conducting industrial training courses in the fields of chemistry, materials, safety and knowledge development.

**1980 - 1981** Deputy Director of the Painting Department, "Wire Painting", Holon

### **Academic experience**

1992 - 2010 Associate Professor, University of North Carolina, USA.

1994 - 1997 Head of the Department of Industrial Chemistry, Shenkar Higher School of Engineering and Design, Ramat Gan

1990 - 1994 Senior Lecturer, Department of Industrial Chemistry, Shenkar.

1986 - 1990 Dean of Students, "Shenkar".

1984 - 1986 Lecturer, Department of Industrial Chemistry, Shenkar.

1981 - 1984 Research Assistant, University of North Carolina, USA.

1979 - 1981 Instructor, Department of Foreign and Continuing Studies, "Shenkar".

### **Military Service**

1972 - 1976 Intelligence Corps, Major (Res.).

## **Professional activities and associations**

Chairman of the Israel Textile and Design Association (1995-1994)

Deputy Chairman of the Israeli Textile and Design Association (1989-1985)

Chairman of the "Yalkot - Journal of the Israeli Textile Association" editorial board.

American Society for Testing and Materials, ASTM Committee F-23 on Protective Clothing.

The Fiber Society - Princeton, USA, member.

American Association of Textile Chemists and Colorists - AATCC, USA, senior member.

Society of Dyers and Colourists - UK, member corporate.

## **Selection of industrial projects**

"Israel Chemicals - Industrial Products Ltd.", Beer Sheva - Flame Retardants and Biocides.

"Noam", Kibbutz Urim - disposable fabrics.

"BG Polymers", Beit Guvrin - Fire-resistant adhesives.

"Israel Electric Company", Haifa - protective clothing for high voltage.

Teva Pharmaceutical Industries Ltd., Petah Tikva - Medical Devices.

"Shiltex", Schiller Group - safety straps and cables and climbing.

"KAN Textiles Ltd.", Rishon LeZion, Curing of elastic fabrics.

"Ministry of Defense", Tel Hashomer - Avak clothing.

"Ichilov Medical Center", Tel Aviv - antiseptic procedure in industrial laundry.

"Assaf Harofeh Medical Center", Tzrifin - operating room and hospitalization clothing.

"Kitan", Hadar Yosef, Tel Aviv - fireproof fabrics.

"Hogla", Hadera - antibacterial fabrics.

"Albad", Yitzhak Beacons - Non-woven fabrics.

"Textiflik" Edirne, Turkey - Microfiber.

Idyll Fastner Corp., Oxford, USA - Closures for Chemical Protective Clothing.

"Piedmont as Michaels Corp.", Greensboro, USA - Textile Improvement Chemicals.

"Alexium", Grinoel, USA - Military clothing.

"Haifa Chemicals" Haifa - protective clothing.

"Disk-O-Tech", Herzliya - orthopedic implant.

"Thyme Digital Ltd.", Rosh HaAyin - digital printing.

Inspire Medical Ltd., Tel Aviv - wrapped stents.

"Fluketex", Kiryat Malachi - upholstery fabrics.

"GoldenGard", Jerusalem - protection from ultraviolet radiation.

"Glossy dental system" - dental equipment.

"Filteflex" - water treatment.

"Polychrome SP Materials" - Nanotechnology in composite materials.

Coates, UK - Composites

"Hinoman", Dekel - Agrotech

Adviser to the Ministries of Defense and Health on safety and protection issues.

## **A selection of professional publications and patents**

1. **I. Shalev** and R. L. Barker, "Analysis of Heat Transfer Characteristics of Fabrics in an Open Flame Exposure", *Textile Research Journal*, **53**, 475-482 (1983)
2. M. Kazmierczak, **I. Shalev** and R. L. Barker, "A Computerized Approach to Evaluating Performance of Heat resistant Protective Fabrics", *Journal of Industrial Fabrics*, **1**, 7-21 (1983)

3. **I. Shalev** and R. L. Barker, "Protective Fabrics: A Comparison of Laboratory Methods for Evaluating ThermProtective Performance in Convective/Radiative Exposures", *Textile Research Journal*, **54**, 648-654 (1984)
4. **I. Shalev** and R. L. Barker, "Transient Thermophysical Properties of Thermally Degrading Fabrics and Their Effect on Thermal Protection", in Proceedings of the Fiber Society Conference on High Performance Textile Structures, June 6-8, PCT&S, Philadelphia, PA, 1-4 (1984)
5. **I. Shalev**, "Textiles for Thermal Protection - A Review: Part A", *Yalkut Israel Textile Journal* \*, **104**, 28-32 (1985) - in Hebrew.
6. **I. Shalev**, "Textiles for Thermal Protection - A Review: Part B", *Yalkut Israel Textile Journal*, **106**, 7-10 (1985) - in Hebrew.
7. **I. Shalev**, "Preventing Faults in Batch Dyeing Processes", *Yalkut Israel Textile Journal*, **106**, 26-29 (1985) - in Hebrew.
8. **I. Shalev**, J. Azoulay and D. Amir, "The Effect of Resin On Cotton Fabric Conductance", *Yalkut Israel Textile Journal* **109**, 13-15 (1986) - in Hebrew.
9. **I. Shalev** and R. L. Barker, "Predicting the Thermal Protective Performance of Heat Protective Fabrics from Basic Properties", in *Performance of Protective Clothing, ASTM STP 900*, R. L. Barker and G. C. Coletta, Eds. American Society for Testing and Materials, Philadelphia, PA , pp. 358-375 (1986)
10. **I. Shalev** and R. Feldenkreise, "Performance of Radiantly Heated Flame Retardant Cotton Fabric", *Yalkut Israel Textile Journal*, **112**, 13-15 (1987) - in Hebrew.
11. S. Efrat, **I. Shalev** and S. Raz, "Israel's Textile and Clothing Industry", *The Economist-Textile Outlook International*, No. 20, 8-18, November 1988.
12. **I. Shalev** and R. L. Barker, "Effects of Permanent Press Resin Finish on Cotton Fabrics Thermal Resistance", in *Performance of Protective Clothing - Second Volume, ASTM STP 989*, S. Z. Mansdorf and R. Sager, Eds. American Society for Testing and Materials, Philadelphia, PA , pp. 121-130 (1988).
13. R. L. Barker, S. K. Stamper and **I. Shalev**, "Measuring Protective Insulation of Fabrics in Hot Surface Contact", in *Performance of Protective Clothing-Second Volume, ASTM STP 989*, S. Z. Mansdorf and R. Sager, Eds. American Society for Testing and Materials, Philadelphia, PA, pp. 87-100 (1988).
14. **I. Shalev** and G. Gutman, "Multiple Layer Thermal Protection", *Yalkut Israel Textile Journal*, **117**, 11-13 (1988) - in Hebrew.
15. G. Aviv and **I. Shalev**, "Simultaneous Cationization and Softening of Cellulosic Fabric Utilizing a Bound Surfactant", in Proceedings of the 4th Israeli Conference on Chemistry, Technology and Applications of Surface Active Agents, Dead Sea, Dec. 14-15, p. 74 (1988).
16. **I. Shalev**, Proceedings of the 9th International Symposium on Thermal Analysis, *Thermochemica Acta*, (1989).
17. **I. Shalev**, "Cellulosic Nonwovens for Thermal Protection", *INDA Journal of Nonwovens Research*, **2**, 14-18 (1990).
18. R. L. Barker, **I. Shalev**, S. K. An and B. J. Scruggs, "Comfort Properties of Single Layer Aramid Workwear Fabrics", in Proceedings of the Fifth Conference on Environmental Ergonomics, Maastricht, the Netherlands, Nov. 2-6, (1992).
19. H. Hamouda, R.L. Barker, **I. Shalev** and J. Kim, "Instrumented Methods for Measuring the Surface Frictional Properties of Softener Treated Fabric", *Textile Chemist and Colorist*, **25** (8), 15-20 (1993).
20. S. S. Woo, **I. Shalev** and R. L. Barker, "Heat and Moisture Transport Through Non-Woven Fabrics Part I: Heat Transfer", *Textile Research Journal*, **64**, 149-162 (1994)
21. J. P. Rust, T. L. Keadle, D. B. Allen, **I. Shalev** and R. L. Barker, "Tissue Softness Evaluation by Mechanical Stylus Scanning", *Textile Research Journal*, **64**, 163-168 (1994)

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\* *Yalkut Israel Textile Journal* is abstracted in Chemical Abstracts and World Textile Abstracts

22. S. S. Woo, **I. Shalev** and R. L. Barker, "Heat and Moisture Transport Through Non-Woven Fabrics Part II: Moisture Transfer", *Textile Research Journal*, **64**, 190-197 (1994)
23. J. J. Kim, **I. Shalev** and R. L. Barker, "Softness Properties of Paper Towels", *TAPPI Journal*, **77**, No. 10 (1994)
24. D. B. Allen, J. P. Rust, **I. Shalev** and R. L. Barker, "Development of a Mechanical Stylus Based Surface Analysis System for Soft Products". 1994 Nonwovens Conference *TAPPI Proceedings*, TAPPI Press, Atlanta, GA. p. 133, (1994).
25. J. P. Rust, T. L. Keadle, **I. Shalev** and R. L. Barker, "Evaluation of Surface Softness of Tissue Paper Products Using Mechanical Stylus Scanning, Optical Image Analysis and Fuzzy Sets", 1994 Nonwovens Conference *TAPPI Proceedings*, TAPPI Press, Atlanta, GA. p. 139, (1994).
26. **I. Shalev** , R. L. Barker, S. P. Hersh, S. M. Maini, B. J. Scruggs, G. Wu, V. K. Sood and P. A. Tucker, "Aerosol Protective Fabrics and Their Comfort", in *Performance of Protective Clothing: Fifth Volume, ASTM STP 1237-Special Technical Publication*, J.S. Johnson and S.Z. Mansdorf, Eds., American Society for Testing and Materials, Philadelphia (1995)
27. P.L. Chen, R. L. Barker and **I. Shalev** , "Heat And Moisture Transfer Of Multi-Layer Fabrics," in *Environmental Ergonomics-Recent Progress and New Frontiers*, Y. Shapiro, D. S. Moran and Y. Epstein, Eds, Freund Publishing, London, pp 275-278 (1996).
28. Jong Jun Kim, R. L. Barker and **I. Shalev** , "Dynamic Analysis of Local Extension in Fibrous Webs," in Abstracts of the Second Symposium on Frontiers in Biomedical Polymers, April 6-9, Eilat, Israel, p. 78 (1997).
29. M. Pawar, R.L. Barker, **I. Shalev** , H. Hamouda, W.P. Behnke, and M. Bender, "Analyzing the Performance of Protective Garments in Manikin Fire Tests", in *Fifth Scandinavian Symposium on Protective Clothing*, R. Nielsen and C. Borg, Eds., SiD/BSR4 Publications, Copenhagen, pp. 59-67, (1997).
30. C. R. Barnes, M.G. McCord, P.T. Tucker, R.L. Barker, **I. Shalev** and J.L. Zingelmann, "Bloodborne Hazard Protective Apparel with Reasonable Comfort", in *Performance of Protective Clothing: Sixth Volume, ASTM STP 1273*, Jeffrey O. Stull and Arthur D. Schwoppe, Eds., American Society for Testing and Materials, Philadelphia, pp. 176-189 (1998).
31. **I. Shalev**, R.L.Barker, M.G. McCord, and P.A. Tucker, "Protective Textile Particulate Penetration Screening," in *Performance of Protective Clothing: Sixth Volume, ASTM STP 1273* Jeffrey O. Stull and Arthur D. Schwoppe, Eds., American Society for Testing and Materials, Philadelphia, (1998).
32. **I. Shalev** and E. Rivkind, "Reduction of Dye in Effluent Using Recyclable Cellulosic Waste", in *100 Years of Modern Fiber Science-Proceedings of the Fiber Society International Technical Symposium*, Asheville, NC, July 6-10, (1998).
33. R. L. Barker, B. J. Scruggs and **I. Shalev** , "A Comparison of the Comfort Properties of Nonwoven and Woven Fabric in Operating Room Gowns ". INDA-TEC 98, Association of the Nonwoven Fabrics Industry , Cary, NC, (1998).
34. R. L. Barker, H. Hamouda, **I. Shalev** and J. Johnson, "Review and Evaluation of Thermal Sensors for Use in Testing Firefighter Protective Clothing ". NIST GCR 99-772, National Institute of Standards and Technology , Gaithersburg, MD, (1999).
35. C. Choi Yoo, **I. Shalev** , R. L. Barker and B. Scruggs "Thermophysical and Sensorial Properties of Heat Resistant Workwear Materials. Part I: Instrument Analysis of Fabric Properties," published in *Proceedings of the IFAI Textile Technology Forum*, San Diego, CA, October 1999.
36. C. Choi Yoo, **I. Shalev** , R. L. Barker and B. Scruggs , "Thermophysical and Sensorial Properties of Heat Resistant Workwear Materials. Part II: Perceived Comfort Response to Garments," published in *Proceedings of the IFAI Textile Technology Forum*, San Diego, CA, October 1999
37. H. Hamouda, R. L. Barker, J. Johnson, **I. Shalev** and M. Bender, "Comparison of Heat Sensors for Use in Testing Thermal Protective Performance,". in *Performance of Protective Clothing: Seventh Volume, ASTM STP 1386*, C. N. Nelson and N. W. Henry, Eds., American Society for Testing and Materials, West Conshohocken, PA, (2000).

38. R. L. Barker , **I. Shalev** , M.G. McCord, P.A. Tucker and B.R. Lisk, "Protective Textile Particle Penetration," in *Performance of Protective Clothing: Seventh Volume, ASTM STP 1386*, C. N. Nelson and N. W. Henry, Eds., American Society for Testing and Materials, West Conshohocken, PA, (2000).
39. L. Myhre, B. Scruggs, **I. Shalev** , R. L. Barker, C. Prasharn, and T. Miszko, "Effects of Measured Heat Loss Through Turnout Material in Firefighter Comfort and Heat Stress Part I: Performance in a Mild Environment," in *Performance of Protective Clothing: Seventh Volume, ASTM STP 1386*, C. N. Nelson and N. W. Henry, Eds., American Society for Testing and Materials, West Conshohocken, PA, (2000).
40. L. Myhre, B. Scruggs, **I. Shalev** , R. L. Barker, C. Prasharn, and T. Miszko, "Effects of Measured Heat Loss Through Turnout Material in Firefighter Comfort and Heat Stress Part II: Performance in a Warm Environment," in *Performance of Protective Clothing: Seventh Volume, ASTM STP 1386*, C. N. Nelson and N. W. Henry, Eds., American Society for Testing and Materials, West Conshohocken, PA, (2000).
41. R.L. Barker, B. Scruggs and **I. Shalev** , "Evaluating Operating Room Gowns: Comparing Comfort of Nonwoven and Woven Materials," *International Nonwovens Journal*, Vol. 9, No. 1, pp 23-29, April (2000).
42. R.L. Barker, H. Hamouda, **I. Shalev**, J. Johnson. "Review and Evaluation of Thermal Sensors for Use in Testing Firefighter Protective Clothing: Final Report, Report (National Institute of Standards and Technology (US)), 2001 Mar., 56 p. Report: NIST/GCR99/772.
43. **I. Shalev** and A. Cherkassky, "Analysis Of Fabric Lot Flow Through Batch Dyeing and Finishing Operations by Computer Aided Simulation", The Industrial Simulation Conference 2003, Valencia, Spain, (2003).
44. **I. Shalev** and M.A. Goldenhersh, US *Patent* No. 6,610,214, " UVR Attenuation of Fabrics and Finished Textiles," August, 26, (2003)
45. R.L. Barker, H. Hamouda, J.W. Johnson, **I. Shalev** and M. Bender, "Comparison of Heat Sensors for Use in Evaluating the Thermal Protective Performance of Clothing Materials," accepted for publication in *Journal of Manufacturing Science and Engineering*. (2004).
46. R.Mazor, M. Peled and, **I. Shalev**, "Flame Retardant Systems for Upholstery Fabrics," published in *Proceedings of 15th Annual BCC Conference on Recent Advances in Flame Retardancy of Polymeric Materials*, Stamford, CT, (2004).
47. **I. Shalev**, R. Mazor, A. Shoshan, M. Peled and E. Rapaport, *Patent* -WO/2007/096883 – "Washing-Fast Smoldering-Suppressing Compositions", (2006)
48. **I. Shalev**, R. Mazor, *Patent* , "WO/2006/072952 - -Sized Halogenated Flame Retardant Nano (2005)
49. **I. Shalev** and K. Faulkner, US *Patent* No 7,398,660 – "Dyeing apparatus and method thereof". (2008)
50. R Mazor, **I Shalev**, A Shoshan and M Peled - US *Patent* No 7,504,449 – " Flame Retardant Compositions", (2009)
51. R. Mazor, **I. Shalev**, N. Zer-Zion, US *Patent* 20090250671 "Aqueous Dispersion of Flame Retardant for Textiles and Process for Producing Same" (2009)
52. R. Mazor, A. Shoshan, **I. Shalev**, M. Peled, "Flame Retardation of Textiles by Halogenated Aryl Phosphonates", US 2011/0306258 A1 (2011)