Tuesday, July 14, 2020

Nir Tessler (Short Bio)

Nir Tessler is a professor of electrical engineering and is the Barbara and Norman Seiden Chair. He is currently the head of the microelectronics and nanoelectronics centers of the Technion, which perform as a national infrastructure.

Academic Degrees:

1989	B.Sc. Summa Cum Laude	Department of Electrical Engineering, Technion, Haifa, Israel
1992	M.Sc.	Department of Electrical Engineering, Technion, Haifa, Israel
1995	D.Sc.	Department of Electrical Engineering, Technion, Haifa, Israel

Academic Appointments

2008	Professor	Department of Electrical Engineering, Technion, Haifa, Israel
2003	Associate Professor	Department of Electrical Engineering, Technion, Haifa, Israel
October 1999	Senior Lecturer	Department of Electrical Engineering, Technion, Haifa, Israel
1999	EPSRC advanced fellow	Cambridge University, Cavendish Laboratory, UK.
1997-1999	Senior Research Associate	Cambridge University, Cavendish Laboratory, UK.
1997	Academic Guest	Department de Physique, Institute de Micro-et Optoelectronique, Ecole Polytechnique Federal de Lausanne (EPFL).
1995-1997	Research Associate	Cambridge University, Cavendish Laboratory, UK.

Professional Experience Outside Academia:

2003-2010	CTO and Co-Founder, Peptronics Ltd.
2007	CTO and Co-Founder, Carbon Valley Technologies
2002	Consultant, Technology evaluation for Visson
2000-2001	Consultant, Inksure Technologies Inc.
1988-1999	Student member of The Technical Staff, Electronics Department, RAFAEL Acre, Israel
1987-1989	Computer Operator, Computer Department, Tambur Acko, Israel
1982-1985	Training and Exercise Co-ordinator Officer, Israel Air Force

Participation in organizing conferences

Conference title	Location	date	organizational function
Photonics Europe, The international society for optical engineering (SPIE)	Strasbourg, France	2004	Scientific committee
Materials Research Society (MRS)	San-Francisco	2005	Organizing committee

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Membership in Professional Societies

IEEE
Materials Research Society
Israeli Chemical Society

Honors

The President of the Technion, Excellence Award 1986,1987,1988

The Gutvirt Fellowship, Special Excellence Scholarship 1991

The Minister of Communication, Excellence Scholarship 1993

The Charles Clore Foundation, Excellence Scholarship 1994

The Rothschild Post Doctoral Fellowship 1996

AVI Fellowships, Post Doctoral Fellowship 1997

Engineering and Physical Sciences Research Council, UK, Advanced Fellowship 1999

Alon Fellowship 1999

Andre and Bella Meyer academic lectureship - France 2000-2001.

Friedenberg special research award 2000

Gutvirt price for active research (Henry Gutvirt Fund for the promotion of research)

David Ben Aharon prize (2004)

Henry Taube prize for academic excellence (2010)

Hershel and Hilda Rich Technion Innovation award (2011)

IBM Faculty Award (2013)

Uzi and Michal Halevi, Innovative applied engineering award (2016)

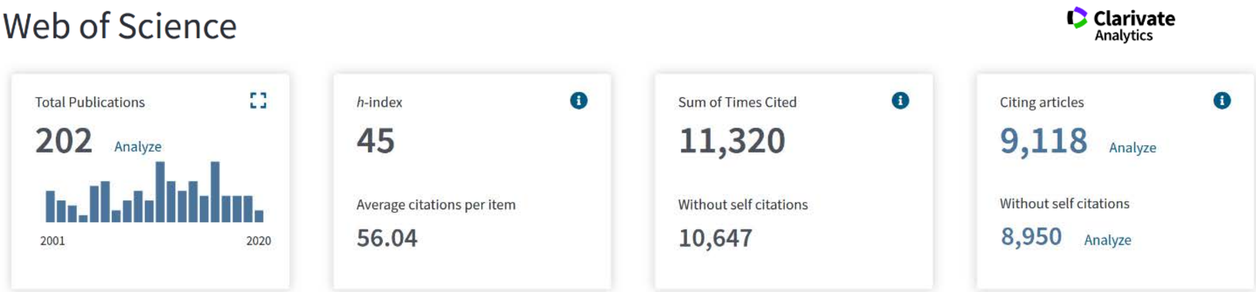
PUBLICATIONS

April 2009 PDF

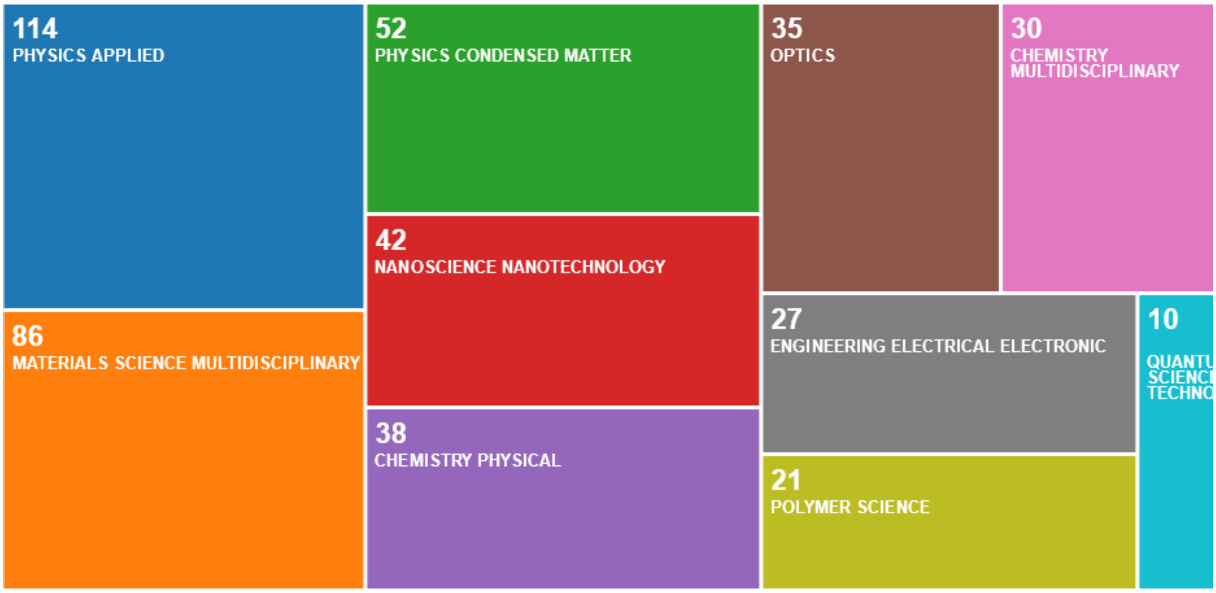
Nir Tessler
Featured Scientist from *Essential Science Indicators*SM

In February 2009, Essential Science Indicators *from Thomson Reuters welcomed Dr. Nir Tessler to the top 1% in the field of Chemistry. Prior to this, his work has also appeared in the top 1% in the field of Materials Science. His overall record in our databases includes 66 papers cited a total of 3,021 times between January 1, 1998 and December 31, 2008.*

Dr. Tessler is a Professor in the Electrical Engineering Department of The Technion – Israel Institute of Technology in Haifa, Israel.



Publication Ditribution by Field (Interdisciplinarity)



Starting new direction of research for the entire community

Nir's report of the first conjugated polymer laser opened the direction of organic lasers. His series of papers on design, fabrication, modeling, and analysis of vertical OFET structure, invented at the Technion, established this direction that is now followed by many groups. He developed the methodology of self consistently linking device modeling, device fabrication, and device analysis to introduce improved or new device structures.

Documented achievements

Year	Achievement	(Potential) Impact	Relevant publications	# cites
1990-1995	How to modify the design of multiple quantum-well lasers for high speed applications.	Go beyond the 10Gbit limit of telecom, at that time.	TESSLER, N., et al. (1992). " Structure dependent modulation responses in quantum-well lasers" IEEE Journal of Quantum Electronics, **28**(10): 2242-2250. Tessler, N. and G. Eisenstein (1993). "On carrier injection and gain dynamics in quantum-well lasers." Ieee J. Quantum Electronics **29**(6): 1586-1595. Tessler, N. and G. Eisenstein (1993). "Distributed nature of quantum-well lasers." Appl. Phys. Lett. **62**(1): 10-12.	358
My “magic-years” at the Cavendish lab with Prof. Sir Richard Friend				
1996	World’s first “plastic laser” based on semiconducting organic molecule (polymer)	Anyone in the world made the connection: Laser means the materials are mature enough. 1996-1998 witnessed a surge of international companies joining the race for producing OLED screens.(*)	Tessler, N., et al. (1996). "Lasing from conjugated-polymer microcavities." Nature **382**(6593): 695-697. Denton, G. J., et al. (1997). "Factors influencing stimulated emission from poly(p- phenylenevinylene)." Phys. Rev. Lett. **78**(4): 733-736. Tessler, N. (1999). "Lasers based on semiconducting organic materials." Adv. Mater. **11**(5): 363-370.	2253
1997	Demonstrated for the first time that it is possible to use a 2D structure to produce 3D confinement.	The implications are numerous but, as far as I know, it was never picked up.	Tessler, N., et al. (1997). "Suppressed angular color dispersion in planar microcavities." APPLIED PHYSICS LETTERS **70**(5): 556-558.	66
1998	Initiated the construction of the world’s first smart-pixel	Proved that thin flexible screens are feasible	Tessler, N., Sirringhaus, H. and Friend, R.H. (1998), Patent WO1999054936A1 Sirringhaus, H., Tessler, N., and Friend R.H.,. (1998). "Integrated Optoelectronic Devices based on Conjugated Polymers." SCIENCE **280**: 1741-1743.	3351

1998	Organic molecules (within OLED) can sustain current densities of $kAcm^{-2}$ and produce light intensity in the millions of Cdm^{-2}.	Proved the robustness of organic molecules and that they can withstand the currents. Till today, the main degradation of OLEDs is in the contacts or injection layers. Not the material itself!!	Tessler, N., et al. (1998). "High peak brightness polymer light-emitting diodes." Adv. Mater. **10**(1): 64-68.	231
1998-1999	Showed for the first time that in phosphorescent OLED, a phosphorescent molecule can act as triplet scavenger.	Quantifying charge and energy transport showed that the exciting paper by Baldo et. al. (Naure,1998) had also sound scientific base.	Cleave, V., et al. (1999). "Harvesting singlet and triplet energy in polymer LEDs." Advanced Materials **11**(4): 285-288. Cleave, V., et al. (2001). "Transfer processes in semiconducting polymer-porphyrin blends." Advanced Materials **13**(1): 44-+.	570
1998	Current heating and heat equivalent circuit of OLEDs	OLED contacts started to be made of thicker metals to allow efficient heat removal → significant lifetime boost.	Tessler, N., et al. (1998). "Current heating in polymer light emitting diodes." Appl. Phys. Lett. **73**(6): 732-734.	123
1999	Refractive index tuning and the world's first all polymer conducting DBR mirror (or microcavity OLED).	First demonstration of controlled electronic doping of conjugated layers. All commercial OLEDs use doped injection layers	Ho, P. K. H., et al. (1999). "All-polymer optoelectronic devices." Science **285**(5425): 233-236.	345

Back at the Technion (2000-)				
2002-	Discovered/reported the charge density dependence and effect of polymer MW dep. morphology on charge transport in organic materials.	Allowed for self-consistent device modeling of OLEDs, OFETs, OPVs, and organic thermoelectric. It is currently being used to design the break through the 20% efficiency limit of OPVs.	Roichman, Y. and N. Tessler (2002). "Generalized Einstein relation for disordered semiconductors - Implications for device performance." Applied Phys. Lett. **80**(11): 1948-1950. Shaked, S., et al. (2003). "Charge density and film morphology dependence of charge mobility in polymer field-effect transistors." Advanced Materials **15**(11): 913-916. Roichman, Y., et al. (2004). "Analysis and modeling of organic devices." Physica Status Solidi a-Applied Research **201**(6): 1246-1262. Tessler, N., et al. (2009). "Charge Transport in Disordered Organic Materials and Its Relevance to Thin-Film Devices: A Tutorial Review." Advanced Materials **21**(27): 2741-2761.	972
2001-2003	Organic LEDs (OLEDs) operating at telecom wavelengths	Low cost fiber-to-the-home components for high speed internet to everyone	Tessler N. and Banin U., (2001), Patent WO03038914A3. Tessler N., et al. (2002). "Efficient near-infrared polymer nanocrystal light-emitting diodes." SCIENCE **295**(5559): 1506-1508. Holder, E., et al. (2008). "Hybrid nanocomposite materials with organic and inorganic components for opto-electronic devices." JOURNAL OF MATERIALS CHEMISTRY **18**(10): 1064-1078.	1613
2003-2006	First realization of semiconducting peptides through standard peptide synthesis	Silicon industry standard grade can be achieved in "chemical synthesis" of organic semiconductors. This concept wasn't picked up.	Eichen Y., et. al., patent WO2004039862 Tessler, N., et al. (2006). Conjugated Polymer Electronics – Engineering Materials and Devices. Handbook of Conducting Polymers. T. A. Skotheim and J. R. Reynolds. London, CRC.	--

2006-	New vertical transistor structure	Allows the use of “poor performing semiconductors” for demanding applications (as drivers in OLEDs screens or High Power devices)	Tessler N., et. al., Patent US2013/0056835Al Ben-Sasson, A. J., et al. (2009). "Patterned electrode vertical field effect transistor fabricated using block copolymer nanotemplates." APPLIED PHYSICS LETTERS **95**(21): 213301.	76
2008-2011	Showed that the molecules attached to semiconducting nanocrystals (or quantum dots) to provide solubility can be modified and used to control and adjust the electronic properties of the dot without having to synthesize a new type of dot	Adding an engineering toolbox on the material level makes it easier to commercialize quantum-dot based optoelectronics.	Soreni-Harari, M., et al. (2008). "Tuning Energetic Levels in Nanocrystal Quantum Dots through Surface Manipulations." Nano Lett. **8**(2): 678-684. Yaacobi-Gross, N., et al. (2011). "Molecular control of quantum-dot internal electric field and its application to CdSe-based solar cells." Nat Mater **10**(12): 974-979.	251
2014-	Accidental discovery that the molecule $C_{60}F_{48}$ is an efficient dopant to organic semiconductors	Starting at 2014, papers around the world are showing the benefit of using $C_{60}F_{48}$ (as in high conductivity and workfunction tuning of CVD-graphene or high mobility, ~10cm^{2}v^{-1}s^{-1}, plastic transistors)	Tessler N. and Solomeshch O., patent US 8431,434 B2 Solomeshch, O., et al. (2009). "Ground-State Interaction and Electrical Doping of Fluorinated C-60 in Conjugated Polymers." ADVANCED MATERIALS **21**(44): 4456-4460. Paterson, A. F., et al. (2016). "Small Molecule/Polymer Blend Organic Transistors with Hole Mobility Exceeding 13 cm^{2}V^{-1}s^{-1}." ADVANCED MATERIALS **28**(35): 7791-7798.	139
2016-2019	In collaboration with TowerJazz, demonstrated seamless integration of plastic (organic) photodiodes with standard CMOS circuit to result in a hybrid camera.	Making silicon-based camera, sensitive to the near infrared region so that it can also “see temperature” has never been easier.	Shekhar, H., et al. (2017). "Low dark leakage current in organic planar heterojunction photodiodes." APPLIED PHYSICS LETTERS **111**(22): 223301. Shekhar, H., et al. (2020). "Hybrid image sensor of small molecule organic photodiode on CMOS – Integration and characterization." Scientific Reports **10**(1): 7594.	15

(*) *In May 1996 I was queuing to the registration of a Royal society meeting in London. At the time, most people working on trying to make organic lasers would not admit it in public. So, the queue happened to place the “old-fool” who has been advocating lasers for years next to the young ignorant who only started organics 6 months before. I later realized that at that point Prof. Alan Heeger (yet to receive Nobel Prize) already had results showing optical gain in solid films while I only just finished making my first (and last) set of polymer microcavities, and couldn’t wait to go back and test them. I asked Prof. Heeger if he really thought that organic lasers would be important for anything. He bounced the question back to me and we ended agreeing that the most important contribution would be that outsiders to the field would realize that organics have a great future. As we re-discussed* *yesterday (18/July/2020), those who joined, "discovered" that the gap between basic chemical-physics and commercial product contains a lot of "tiny" engineering chellenges. The field was actually saved by Steve Jobs who invented the smart-phone and created the market for tiny screens. 1996 to 2007 is "only"11 years and from 1990 (*Burroughes *et. al., Nature) its 17.*