

The Multifaceted Zvi Yaniv Ph.D.

By C. A. Kennedy



"A true Renaissance man", is a standard shorthand phrase authors use when they encounter exceptionally talented folk who have mastered many fields of endeavor and who entertain varied cultural interests. Dr. Zvi Yaniv for one, for he is certainly well versed in many disciplines, to wit: He is a scientist, an educator, an artist, a musician, a gardener, a businessman, an inventor, a religious instructor, a linguist, a researcher of ancient tribes, husband, father, employer...and on and on.

Along with a robust list of academic honors, Yaniv's Curriculum Vitae informs us that he is President and Chief Operating Officer of SI Diamond Technology, Inc., guiding the company to become a leader in the display industry using electron field emission from diamond carbon films. He is also President and CEO of Applied Nanotech, Inc., a subsidiary of SI Diamond, devoted to application and commercialization of products such as their 14" diagonal carbon nanotube display. He is an authority on electro-optics, liquid crystal technology, amorphous semiconductors and technology commercialization. He is on the board of directors of the Society for Information Display (SID), founded the Metropolitan Detroit and Texas chapters, and was elected a Fellow of SID for his leadership in developing large area high performance active matrix LCDs and scanners. And, he is a Senior Research Fellow of the IC2 Institute of the University of Texas.

Even this excerpt of his long litany of professional accomplishments would justify a writer's Renaissance reference. It would also fall short of the mark. Yaniv is not only gifted in the sciences and arts, extremely intelligent, focused with great drive, and successful in many arenas, his true anima seems to revolve around a passion for pure creativity.

Yaniv relishes the challenges in his life that have allowed him to construct and build from the ground up. These include founding a college of engineering in his 20s "from scratch," establishing a business employing liquid crystal technology years before others comprehended the application values of the emerging nanoscience, patenting breakthrough scientific research, or envisioning a Japanese garden into reality. Even Yaniv's newest musical enthusiasm is based on creative violin improvisation.

Yaniv's creative processes are capable of functioning as Yaniv slumbers. He explained that it is not unusual for him to awaken in the morning with inventive concepts to patent, in kinetic art, for instance. He has formed a company solely to house and patent in excess of 50 "extra ideas" that sort of spill over, all concepts totally unrelated to his work with SI Diamond.

Born in Moldova, Romania, Yaniv knew at the tender age of 10 or 11 years that he would study physics, "I loved it from being exposed to fifth grade math. Eastern European education was excellent in sciences and math. When I came to Israel, I had been in the tenth grade in Romania and I knew enough to pass the 12th grade." The pressure from the Romanian school system requiring high achievement was extreme, and was even more intense for the Jewish students, whose parents demanded even higher scholastic performance. "As Jews we needed to excel because (otherwise) you don't survive."

In 1961, when he was 16 years old, his family immigrated to Israel. Yaniv's normal ebullience clouded slightly as he spoke of those difficult times in his life, "Eastern Europe was not a good place to live if you were Jewish." 1961 was a pivotal year full of dramatic changes for the teenaged Yaniv. As

though mere days had elapsed instead of decades, he recalled the transition from experiencing constant oppression, and the accompanying necessity of preternatural alertness and awareness, to the total freedom and acceptance he found in Israel. And then, suddenly beaming, Yaniv said that it was also the year he met Monica, "his high school sweetheart" and the girl who was to become his future wife.

Following graduation he served with the military, as do most youths in the State of Israel. Yaniv merely acknowledged that experience, eliding those dangerously turbulent times to focus attention upon the period in his life after he was awarded a Bachelor of Science degree in physics/mathematics, and had earned his Masters of Science degree in electro-optics, with distinction, from the Hebrew University of Jerusalem.

Immediately upon obtaining his Masters in 1972, Yaniv was approached by the major of Ber Sheva, the capitol of the desert in Israel. Who proffered the young graduate the daunting task of establishing an Engineering College literally from nothing...definitely his kind of challenge. So, by dint of hard work and effort, the Practical Engineering College of the Ben Gurion University in Ber Sheva was nurtured and developed, and Yaniv was head of the flourishing institution he helped found. Solidly entrenched in academia, happily married, and the father of three, Yaniv was a successful man while still in his late twenties.

In 1979, he convinced the Board of Directors to permit him to take a leave of absence to travel to the United States to pursue a Ph.D. in the study of liquid crystals at Kent State University. With a sure conviction that LC was a coming field, he was ahead of his time. Yaniv notes that he was determined to enter the field even though the researchers at the University were definitely unenthusiastic and even dismissive, commenting that "LC was good only for little watches."

Although the board was reluctant, Yaniv says he persisted, persuaded them to his point of view, and relocated his family to Ohio for what was presumed would be a three-year hiatus from their life in Israel, after which they would return home to a known and familiar future.

Adhering to his timetable, Yaniv recounts that in 1980 he took a Masters in Physics, and by 1982 was awarded his Ph.D. in Liquid Crystal studies. He maintained a 4.0 grade average for both degrees and was awarded the prestigious Student Research Award from the Physics Society. He had achieved his goals and his family had already flown back to Israel, when he was invited to give a talk at Energy Conversion Devices in Michigan. He so impressed the assembly with his knowledge and concepts that they asked him to join in a start up... creating a business in the field he loved. Yaniv was tempted. This venture was precisely tailored to his interests and abilities, and he had never been involved in the fascinating commercial aspects of his science. But, there was his position with the Engineering College to consider and his family was on another continent.

"I was 32. I said, I don't know...can I start something new and exciting?" I called my wife, and my high school sweetheart said, 'You studied so hard, let's try it. I will come back if you will buy a house for the children.' I bought the house."

" So, in 1983 we started a new company named Optical Imaging Systems, OIS, in Troy, Michigan. I was the first employee and the founder." Yaniv "led the company during its years of development and initial commercialization of advanced active matrix liquid crystal displays and amorphous silicon image sensors. By 1986 we went public with \$22 million in assets. All this without knowing business, I only had engineering and academic backgrounds. It was an adventure."

Yaniv quickly summarized the rapid growth of OIS: "By 87, OIS was a leader in TFT (thin film transistor) Active Matrix LCDs; from 87 to 90, OIS became the biggest supplier and developer for the defense industry. We developed flat panel devices for airplanes, including the F-16, C-130 and F-22. By 1990 and 1991, 100 people were employed and we were recognized as the leader in world. We licensed technology to Far East companies such as Unipac (Yaniv was one of the founders of Unipac, currently one of the premier display companies in Taiwan), and we trained Samsung in Korea. Due to the high cost of liquid crystal displays in the United States, the Defense Department began buying from the Far East, and the devices were "ruggedized" (or customized) for their uses."

OIS was a success, the future was promising, and then things took a different turn when another firm acquired the company, bringing new people on board. Yaniv shakes his head slightly, "We didn't see eye-to-eye on the strategy, so by '92 I left the company. It was a major decision. I felt bad, and it was the first time in my life that the people (I was collaborating with) didn't do what I thought was the right thing to do. It was like losing a child. But, (leaving) it was the right thing to do because after three years, it went bankrupt."

"I decided to open my own company - Advanced Technology Incubator- I put all of my ideas and patents into the company, and there were more than 50. It was very successful and made money. I was a consultant to companies in Korea, Israel, India, Japan and other countries.

During this time he entered into an agreement with Dr. Doane, his former professor at Kent State, and with investors and indirect Kent State University involvement, Yaniv became a founder of Kent Display Systems, the "no-power" reflective LCD Company. To make an extremely long story short (some of which can be found on Yahoo), major differences in goals and methods erupted. Yaniv said he watched greed infiltrate his associates as it became obvious that immense profits were possible. Acrimonious lawsuits resulted.

It is quite clear, however, that the worst aspect of the schism and lawsuits for Yaniv was not the loss of monies, or even the company, but the basely anti-Semitic comments and personal attacks made against him. "So strange...even now Kent State students can't talk to me, and my colleagues are worse...anti-Semitic comments were posted on a web site. I won a case against them." Although there are ongoing legal skirmishes, Yaniv now shrugs the whole disheartening experience off and declares he has become quite Americanized, learning to sue with the best of them.

Lawsuit jest aside, Yaniv, who holds dual Israeli/U.S. citizenship, said that, "After awhile it feels like you were born here - I feel fully American. And he fully appreciates the freedom to defend himself with lawsuits. Yaniv maintains close ties with family and friends and business interests in Israel and the Israeli/Palestinian conflict weighs heavily upon him. It is very grave, very difficult. So many mistakes have been made. I'm very worried about the future...not just of the region but of the world."

His decision to move to Texas was classic Zvi Yaniv. In 1996 Yaniv was hired for a consultation with Marc Eller, CEO of SI Diamond Technology, Inc., in Austin, Texas. The Board of Directors felt the company was moving in the right direction. "After two days, I advised them to cut their losses and run. Eller asked me, 'Can you find something...anything?' I studied their patents and saw (there was) a chance to recoup, but with major changes. "They asked me to come manage the company, and I accepted."

At this time, Yaniv says, his family was happily and comfortably dwelling in a well-appointed lakefront home in Michigan. Any concepts the Yaniv family entertained about Texas were probably

gleaned from cinematic stereotypes involving longhorn cattle and cowboy boots. Yaniv expected a bit of resistance, therefore, when he broke the news he had accepted the difficult and challenging offer of reorganizing and reconstituting SI Diamond, which meant moving the household to Austin.

Yaniv remembers his childhood sweetheart and life mate replying, " Now you are really crazy...you go alone! " But", according to Yaniv, "When there is an objective in sight, I am unstoppable...but, in a good way." He says no one can harness him - no one can control him - and that his beloved wife and family figuratively just shake their heads when he takes the bit in his teeth, to use a Texas phrase.

Returning to Austin, Yaniv mounted a campaign to woo wife and family and sought to entice them to the "wilds" of Austin through purchasing a brand new, two-story brick home on the edge of a wooded ravine. Then he bombarded his wife with faxes filled with messages such as, "I'm living all alone in a mansion...come visit." He topped off his efforts by securing an offer from The University of Texas at Austin for Monica to teach Hebrew. His strategy paid off and, with a certain amount of glee, Yaniv says "Now just try to take her out of Austin...she loves it!"

His household secure, Yaniv and Eller began renovating SI Diamond Technologies, a holding company for Applied Nanotech, Inc., which handles research and development toward developing nanotechnology applications; Electronic Billboard Technology, Inc., geared toward marketing of digitized sign technology, and Sign Builder of America, which manufactures high quality signage.

"I had to lay off one hundred people...which was very difficult, and reorganize. We cleaned house in '96 and I learned a lot about the company in '97." We began achieving greater technical results with fewer employees, who now number right at 105, he said. In the next two years the company moved into nanotech development, perfecting it and licensing the use to other firms. Full color digital billboards with moving pictures that could be viewed in full sunlight were one result.

SIDT applications that are moving into public awareness include the large animated billboard, flat panel television screens, miniscule medical x-ray tubes, high intensity light sources, decontamination of biological agents, hydrogen sensors for fuel cells and others (see www.sidiamond.com under Applied Nanotech, Inc.).

Yaniv has full faith in the future of nanotechnology, which he defines as the manipulation, precise placement, measurement, modeling and creation of sub-100 nanometer scale matter.

"People, be they venture capitalists, scientists or in the government, are starting to recognize that the handling and understanding of very small particles is as important to new materials as the genome is to genetics. What genetics did by mapping the gene means they can build humans with preselected properties and increase the lifespan. If one understands nanotechnology, one can build any material - and we can do it now. I believe that we could solve any desired problem...childhood diabetes, for instance... within twelve to eighteen months with the commitment and the resources.

Yaniv's vision for SI Diamond was validated by The J. M Dutton & Associates Research Report which issued a "Buy" Recommendation for SIDTI in April 2002, stating that the firm "is engaged in the development of uses for carbon nanotube field emission technology. We believe the Company's patent portfolio to be worth at least \$40 million, as much as \$80 million, providing a solid valuation base. Nanotechnology is one of today's hottest fields.

http://jmdutton.com/Research/SIDT/Profile/SIDT_Profile_Right.html

SI Diamond is housed in a low-key office complex, a sand-colored pebble aggregate/black glass office, where it blends inconspicuously with others of its ilk. The interior is a SOP office, efficient sans frills. Yaniv says he runs a lean organization, and that is reflected in his small but extremely efficient and courteous staff. Yaniv's office is no nonsense...a working scientist's quasi-organized clutter with newspaper clips of awards and photos. A small world map sports dozens of pushpins denoting destinations in his world travels. He is linguistically blessed and articulate in seven languages, which he employs in speaking and consulting engagements around the globe. Yaniv, dressed down in shirtsleeves and sandals, is personable and disarmingly informal.

While describing his artistic interests, he issues an impromptu invitation to view the home he used to lure his wife to his side, their gardens and art collections. During the drive Yaniv maintains a running commentary, answering questions and jabbing at the tape deck and playing musical selections as he adroitly maneuvers the sedan through curves on the winding, hilly road. He speaks with pride of his three adult children: Esther, 28, a medical doctor in Atlanta; Taly, who earned her BBA and is with American Express in Manhattan, age 24; and Dan, 31, a Therapeutic Leisure Specialist who has his own company, Therapeutic Recreation, in which Dad serves as the board chairman. "I just give orders," Yaniv offers, "this isn't my field, but I wanted to help."

The Yaniv home is meticulously and beautifully landscaped, but it is the unconventional backyard that captures attention. From the rear deck one views the standard Hill Country live oak treetops and a good chunk of Texas sky. Below, however, is a totally different scene of carefully ordered white gravel paths, fountains, meditation benches and hidden nooks. Yaniv sometimes quotes self-dialog in lieu of long explanations: "I have this house on a hill, a big piece of land with ugly backyard... how can I make something that doesn't require too much maintenance?" On a trip to Japan he discovered the beauty of meditation gardens and proceeded to transform a common hillside into a Zen-like retreat with intertwining paths and statuary where he and his dog often share the silence.

Within the Yaniv home is a two-story room lit with tall windows on one wall and an extraordinary display of art on the remaining three walls. Painted by a survivor of Holocaust, Yosel Bergner, it is art that instantly strikes the heart and psyche, powerful, evocative paintings of pain and survival. "I like strong art," Yaniv says as he points out different themes in the collection that stretched toward the ceiling. Also strong, in a very different manner, is an aggregate of vivid indigenous masks acquired during his travels and now line a stairwell so that one meets them face-to-face.



The dining room houses an example of Yaniv's new expression of kinetic art, trademarked Digital Window, which "allows static two- or three-dimensional artworks to become dynamic and interactive." One sees a conventional piece of art which contains a "window," which is another picture composed of a flat panel display that allows the second inserted picture to change. The larger painting could be a Van Gogh and the window could display other selections of Van Gogh's artistry. Or, perhaps the larger picture could be a baby photo whose interior second picture displays the baby in various settings and poses that rotate constantly and would certainly gladden a grandmother's heart.

According to information on his website, Yaniv's "concept will be expanded into 3-D digital images and video display as well as incorporating the flat panel display into sculpture. This new and patented concept is suitable for art as well as commercial purposes. Yaniv plans to continue to work with artists he admires and will expand his concepts to be used commercially. There is no limit to the size or the concepts that can be used." Yaniv maintains a studio in Austin devoted solely to his art, and he has shown in galleries.

Trained in classical violin, Yaniv said, "Now I fiddle." He fiddles to the beautiful rhythms and music of the "Gipsy Kings" from southern France whose music is traditional Spanish Gypsy music and incorporates other influences. It can also be called Flamenco/Rhumba. The vocals are in Spanish, and Yaniv sings along with them.

In addition to his artistic and musical interests, Yaniv is vice president of his synagogue and leads classes on the scientific interpretation of the Book of Genesis. For many years has researched the history of the Khazars, who established the medieval kingdom of Khazaria in far East Europe and Northern China, converted to Judaism in the ninth century and vanished circa 1100 A. D.

He is fully involved in the IC2 program at the University of Texas, making presentations and supporting this innovative program that encourages the dissemination of information.

He has published more than 200 scientific articles, and holds at least 150 patents at last tally and continues to work for the Society of Information Display, a 6,000-member organization dedicated to promoting display research, design, manufacturing, applications and sales of products for telecommunications, medical, government, entertainment and the average consumer.

Dr. Yaniv launched Nanoparticles Application Center (NAC), presently run by SI Diamond Technology, but with the aim of becoming an independent non-profit to encourage members to report research results in nanotechnology and disseminate non-confidential information to advance the use of nanotechnology in immediate applications.

A Renaissance man without a doubt. Can there be a hidden formula or key to the successful versatility Yaniv exhibits in almost every endeavor? One must factor in intelligence, and hard work and vision, and Mrs. Yaniv's support and forbearance, but Zvi, as he is addressed by almost everyone, seems to extract extraordinary joy and zest from life. Yaniv will grin, throw his hands up as if in celebration, and he will tell you the answer is: I'm in love with what I'm doing - always!"

Digital Windows, Inc. Studio and Art Gallery ...proudly presents the works of Zvi Yaniv.
Physicist and high-tech executive creates a new kind of kinetic art by combining art with Digital Windows. Dr. Yaniv is an authority in electro-optics, liquid crystal technology, amorphous semiconductors, and technology commercialization, as well as an art lover and collector.
<http://www.digitalwindows.net/home.htm>

ANI: Future Bodes Well with Strong CNT Emission IP and Alliances

From Nanoparticle News, A BBC Research Publication - a recent chat with Dr. Zvi Yaniv, CEO of Applied Nanotech in Austin, Texas is published as an update to our Profile that follows.

NN: Briefly describe the evolution of ANI and its unique role within Nano-Proprietary Inc?
Yaniv: In 1997 ANI was created by a group of scientists as a subsidiary of publicly-traded SI Diamond Technology, Inc., in Austin, TX. The aim of SI Diamond was to use carbon films for electron emission applications focusing all their efforts in the early stages on diamond films. This is where "diamond" came from.

In 1996 new management came in place and two subsidiaries were formed later, Applied Nanotech and electronic Billboard Technology. In 2003 the SI Diamond name was changed to Nano- Proprietary, Inc. to better describe company strategy, namely, to identify lucrative nanotechnology (NT) applications, create unique intellectual property (IP) and achieve full control on it, prove the concepts described in the IP and then, find strategic alliances for licensing the technology.

NN: What do you believe are your organization's most important NT achievements?

Yaniv: First, is carbon nanotube (CNT) electron emission used in large area color TVs, electron sources and lighting devices. We have recently licensed and negotiated commercial pilot production of some of this technology with Japanese partners including Futaba Corp., and Shimane Masuda Electric and in Taiwan, the Da Ling Co.

Second are functional nanomaterials including CNT composites, metallized CNTs, nanoclay composites, metal carbon fiber composites and dispersed CNT solutions. ANI has established several important research and commercial development partnerships in this sector.

Third, sensors using several platform technologies including: palladium nanoparticles for hydrogen; biosensors based on enzyme coated CNTs for human metabolic analysis, toxic gas detection and chemical warfare sensing; gated metal oxide sensor (GMOS) for CO monitoring; and a photoacoustic sensor capable of identifying several trace gases and vapors. In this sector ANI has ongoing agreements with Kelman Ltd. and the Osaka Gas Co. in Japan.

NN: How does your organization distinguish itself, both intellectually and philosophically, from other similar organizations which are focusing on exploiting NT-based products and their market opportunities?

Yaniv: Our organization has a unique philosophy with respect to NT. Many startup companies don't understand that NT is not an industry, but multiple industries, not a science, but multiple sciences, that will affect all our lives. It is not the fact that you make something small that creates NT. We are nanotechnologists because we are trying to solve macroproblems by eventually getting down to understanding molecular interactions and solving the problem at that level and then returning to the real world creating new products and improving the old ones.

NT is the most creative part of existing sciences and technology. It is this creativity that we want to work on and exploit commercially. The market opportunities we are pursuing came to us from the needs of large corporations that, due to their size and administrative rigidity, cannot be quickly creative. We are trying to understand their technological impasses and solve them at the nanolevel by creating IP and proving the concept of the proposed solutions.

NN: In the area of CNT-based displays how will ANI's technology be able to compete with Samsung's (as well as other display technologies) which is rumored to be launching its first product very soon?

Yaniv: ANI has established a very strong NT IP base of 120 issued and filed domestic and foreign patents in materials, processing, structure and device applications. Specifically ANI holds exclusive rights to U.S. Patent No. 5,773,921, an extremely significant patent which was reissued with many new claims in 2003. Through this patent ANI believes it holds a dominant IP position in CNT FEDs, CNT TVs and many other CNT electron emission applications.

NN: In the area of CNT technology commercialization with Mitsui & Co. Ltd what product market focus do you anticipate?

Yaniv: The strategic alliance agreement with Mitsui is very clear in stating that its main objective is to establish pilot lines for a future manufacturing base in Japan. Further, ANI has also recently established a possible pilot line in Taiwan with Da Ling. Thus ANI is aggressively looking for strategic alliances in order to go to the next stage in CNT display development.

No one is serious enough to introduce a new display technology unless they go through a pilot line phase. So far Samsung has not announced this, whereas both Canon and Toshiba have with respect to their surface electron conduction technology, which ANI is legally contesting. Competitively ANI is well positioned with other display technologies, especially through printing CNT TVs which equates to lower capital investment, as we recently disclosed at the SID 2006 conference.

NN: In view of ANI's current size how is it able to undertake such an ambitious nanobased product/market focus?

Yaniv: Growth will be through our two main divisions, CNT Electron Emission and Functionalized Nanomaterials, which possess strong IP. ANI is growing by working with strategic partners, continuing to improve products and cutting their cost. For the sensor market which is very fragmented we see tremendous growth for our proprietary single and multiple sensors platforms.

NN: What are ANI's short term and longer term goals?

Yaniv: Our short term goals are to achieve licensing of our technology in the field of CNT electron emission and functionalized nanomaterials and, by doing so, achieve profitability as soon as possible. We will then focus on our other longer term goals to finance, without creating losses, methodology in our core NT activities.

NN: As CEO of ANI what are some of the current challenges confronting you?

Yaniv: Mainly, legal challenges related to our case with Canon, and also establishment of strategic alliances to install pilot lines in Asia.

NN: Do you think the fields of nanomaterials and nanotechnology are over-hyped? Why or why not?

Yaniv: I strongly believe in NT and its impact on our economies, financial strength and lives. We should stop identifying NT as something that can be made small. The NT revolution is not the fact that we are trying to cure technical impacts by, for example, bending iron or stronger hammering. Rather it is by understanding the problem on the molecular level and finding a solution nanoscopic in nature that has huge micro- consequences. In my opinion, we will not see NT products in stores like some people believe, but we will see many new or improved products that use NT.