Peter Ngai

OLEDs, the new wave


Arquivo pessoal

By Maria Clara de Maio

Lume Arquitetura: *We would like to know a little bit of your life and experiences on the illumination area. How was it? How did you begin in this area?*

Peter Ngai: My interest in lighting began as an engineering undergraduate at University of California in Berkeley. After taking an illuminating engineering course I realized that lighting is not just science, or engineering, it is also art, architecture, psychology and ergonomic. It encompassed the understanding of a very broad spectrum of human experiences. This fascinated me. After Berkeley, I went on to graduate school focusing in lighting. From then on, I am in lighting ever since. I am very passionate about lighting and it is my life. I breathe lighting; I eat lighting and dream of lighting. Along the way, I was able to contribute to advancements of science and art of lighting. These include mainstreaming indirect lighting; helping in transforming Fluorescent Lighting from T12 to T8 and, from T8 to T5; advanced Lighting Technology and Luminaire Design in areas of Photometry, Computer Rendering for Lighting, Brightness and Glare Research, Lens and Reflector Optics, Sustainable Material, Day Light Harvesting, Ultra-Violet Germicidal Irradiation.

Lume Arquitetura: *What is Acuity Brands Lighting? Is it a private entity supported by the government? What is its mission, what kind of activities they have?*

Peter Ngai: Acuity Brands, Inc., the parent company of Acuity Brands Lighting, Inc. and other subsidiaries, is one of the world's leading providers of lighting fixtures and related products and services with fiscal year 2009 net sales of over $1.6 billion. The Company's brands include Lithonia Lighting®, Holophane®, Peerless®, Mark Architectural Lighting™, Hydrel®, American Electric Lighting®, Gotham®, Carandini®, RELOC®, MetalOptics®, Antique Street Lamps™, Tersen™, Synergy® Lighting Controls, Sensor Switch®, Lighting Control & Design™, and ROAM®. Headquartered in Atlanta, Georgia, Acuity Brands employs approximately 6,000 associates and has operations throughout North America and in Europe and Asia. As the recognized leader in the lighting industry, it is our mission to deliver consistently superior value to our customers and their clients. This commitment permeates everything we do, driving us to continuously develop and improve our products and the processes to fulfill their needs for quality lighting solutions.

Lume Arquitetura: *You recently said to an American magazine that "lighting is not just engineering, but engineering physics, natural science, psychology, art, architecture, physiology and biology, all combined". Lighting, then, would be a "complete" discipline?*

Peter Ngai: Yes, it is a complete discipline that requires holistic thinking from its practitioners. All living things respond to light in some way, and lighting has a profound impact on humans and our visual environments, due to its ability to regulate how our bodies function and our overall wellbeing. For example, picture a building interior that uses natural light in addition to electrical lighting fixtures. For the lighting to be successful, the luminous environment has to meet our psychological appetite for brightness; the

illuminance level has to be engineered to the right level; the photometry has to be optically appropriate; the lighting distribution has to be ergonomically suitable; the luminaires have to be artistic and aesthetically pleasing; lighting controls systems must intelligently sense and manage light levels to take advantage of available sunlight; and characteristics of light such as color should be tuned to both enhance the built space and to align with the aesthetic preferences of the occupants. And, when complete, the holistic lighting experience is far greater than the sum of its parts.

Lume Arquitetura: *Why does it exist in all markets a kind of rivalry or dispute between lighting design and illuminating engineering? Are they not complementary?*
Peter Ngai: Well, I cannot say that there is a rivalry as such, since it is incredibly important to have good lighting design and effective illuminating engineering. The creative tension that sometimes exists is probably due to the tradeoffs we often face when there are varying objectives for a given lighting project. It may sometimes be necessary to trade aesthetics for performance, or performance for cost. However, there are numerous instances in which a collaborative effort between designers and engineers results in a masterful lighting installation that meets the needs of the customer. In North America, as the trend towards green building and sustainability gains traction, it is common to see beautiful, visually-compelling lighting design intersect seamlessly with pragmatic energy conservation and efficiency.

Lume Arquitetura: *"OLED Today and Tomorrow" was the theme of the seminar held last May at the Light Fair in Las Vegas by you and the Lightning Designer Naomi Miller. Probably one of the reasons why there was such an interest of so many people was the curiosity about the lighting source that starts to develop on the industrial and commercial environment. Can you tell us a bit of this story and explain what this technology consists of?*
Peter Ngai: This has a lot to do with the character of the light emitting from an OLED source. It is calm and comfortable. There is a "noble" quality to the light. Other light sources, be it fluorescent or HIDs, they are harsh and full of glare when viewed directly. We have to tame these traditional light sources with baffles, lenses, louvers or other optical means. Seldom can we view the light source directly. OLEDs offer us the opportunity to appreciate the source. It is meant to be seen and to be appreciated.

The modern, efficient OLED as we know it today was invented by Ching W. Tang and Steven Van Slyke at Eastman Kodak in the 1980s. This device used a novel two-layer structure with separate hole-transporting and electron-transporting layers such that recombination and light emission occurred in the middle of the organic layer. This resulted in a reduction in operating voltage and improvements in efficiency, and started the current era of OLEDs. Later, this concept was adapted for use with polymers as shown in a 1990 paper by Burroughes et al. at Cambridge. They reported a very-high-efficiency green-light-emitting polymer OLED, also called a PLED. OLEDs today have not deviated much from those early examples. Typically, the OLED device consists of a glass substrate coated with ITO (indium tin oxide, a transparent conductor); several organic layers and a reflective metal cathode. The organic layers and the cathode are currently deposited in a vacuum; however, cheaper, solution-based deposition methods are being actively investigated. Upon passing a current through the device, light is emitted from the anode side. This simplicity is one of the most appealing aspects of an OLED.

Lume Arquitetura: *How are researches about OLED Performance concerning efficacy, life and lumen maintenance, CRI, intensity distribution and luminance emittance?*
Peter Ngai: At the Society for Information Display Symposium held in May in Seattle, WA, a white OLED pixel with 79 lumens per watt (lm/W), a CRI of 80, a CCT of 2910K, and an expected 70% lumen maintenance of 25,000 hrs from 1000 candela/m^2 was reported. With improved out-coupling, this pixel could deliver 113 lm/W. The best large-area OLED panel has an efficacy of 50 lm/W and a 70% lumen maintenance of 10,000 hours. OLED emission is inherently near Lambertian, so some intensity shaping is required, especially at high luminance exitance to reduce glare.

A number of major global companies, Samsung, LG, Philips, and DuPont, to name a view, are conducting OLED research. According to the technology road map published by the US Department of Energy, OLED panel efficacy is projected to rise to 105 lm/W in 2015 and to 157 lm/W in 2020. The luminance maintenance is projected to rise to 50,000 hrs and the luminance exitance to 10,000 lm/m^2 in 2015. Our own expectation is that the above performance goals will be achieved two years prior to the DOE road map.

Lume Arquitetura: *Naomi presented in the speech some good possibilities to use the OLEDs on lighting design and luminaries design, but also raise some doubts about the OLEDs, as requirement of remote driver and Power supply, flicker, glare, heat, CRI, etc. Many of these problems were present during the LEDs development. What is the importance of these points? How relevant are these points? How are researches and study concerning this matter? Time to solve will be much shorter than it was for LED?*
Peter Ngai: Some of the challenges that existed in the earlier stages of LED market

introduction have now been resolved, and in some cases, these technological and market advances will have spillover benefits for OLED lighting. Examples of this include the development of solid-state lighting standards and testing protocols, and improvements in driver efficiency and reliability. Given the fact that OLEDs are an area source, some of the prevailing issues facing LEDs, like thermal management, become less of an issue for OLEDs. We are excited about the vast promise of OLED technology and the uniqueness of this new source.

Lume Arquitetura: *Is there a way to compare LEDs and OLEDs? How?*
Peter Ngai: I think it is important to note that using both LEDs and OLEDs when lighting a space may be the most optimal outcome the industry can hope for. In lighting, we have always needed directional as well as diffuse-area luminaires. With the advent of solid-state lighting, we are now able to use an almost perfect point source when designing with LEDs, which enables us to precisely control lighting distributions while minimizing glare. With OLEDs, we have an ideal area emitter, allowing us to design luminaires that celebrate this light source (as opposed to hiding the lamp behind baffles and lenses).

Lume Arquitetura: *The use of LEDs on Lightning Architecture took years of investments and efforts made by the industries to implement the product. You already can frequently find LEDs installation in some wealthier countries but on other ones, they only appear shyly. In your opinion, how will the OLED be implemented in countries that are only now receiving the LED technology?*
Peter Ngai: Perhaps the best way to discuss that is to cite the Haitz's Law, which predicts the steady improvement over the years of light-emitting diodes – LEDs. It states that every decade, the cost per lumen (unit of useful light emitted) falls by a factor of 10, the amount of light generated per LED package increases by a factor of 20. We expect OLED will follow the same trend as LEDs for lighting. At this time, OLED technology is about 3 to 4 years younger than LED technology.

Lume Arquitetura: *Low quality / low cost products invaded the CFLs and LEDs markets. Will it also happen with the OLEDs or will the production costs prevent that?*
Peter Ngai: This can happen in OLED lighting market if we do not make a concerted effort to prevent it. We, at Acuity Brands, have been working very hard to educate the OLED industry about good quality lighting – specifically, the brightness required, intensity shaping, color quality, life expectancy, efficacy levels, and other key characteristics. We also convey the importance of the aesthetic and emotional aspects of OLED lighting. By doing this, we are optimistic that quality issues for OLED can be minimized.

Lume Arquitetura: *What is your opinion about the ban of incandescent lamps? In your opinion, the substitution of the incandescent lamps by CFLs, although questioned due to the poor quality and danger to the environment, could be only a step to the definitive implementation of the LEDs and the consequent payback after decades of investments made by the industries?*
Peter Ngai: The key reason behind the phase-out of incandescent lamps, reductions in energy usage, is very positive. Given the energy load of most buildings, the ability to light spaces more efficiently will have a large impact on global energy consumption. Without question, this provides a large opportunity for solid-state lighting, both LEDs and OLEDs, in that, we are now able to deliver light in more efficacious ways while also focusing on other important lighting characteristics such as color quality. The incandescent lamp, while inefficient and short-lived as compared to other lighting sources, renders colors extremely well, which is very important in many residential and commercial lighting applications. Compact fluorescent lamps have not performed as well in this regard, so customers often feel that they are sacrificing aesthetics for efficiency. As OLED and LED sources improve, we have more opportunities to provide customers with sustainable lighting solutions that offer the best of both worlds.

Lume Arquitetura: *What do you know about the illumination area in Brazil?*
Peter Ngai: Brazil is a leader in the Americas and beyond when it comes to lighting design and specification, and the impact of globalization on lighting has been significant and shows no signs of slowing down. We are familiar with the Brazilian market and with lighting design associations that are active in the country (AsBAI being just one example). Brazil is known for its modern, design-forward aesthetic in lighting design as well as its openness to new and emerging technologies. Over the years, we have seen an increase in the use of lighting controls in interior environments, and LED technology, while still in its early stages, is starting to become more widely used.

We have also observed increasing awareness about sustainability and green building, and local architects are pursuing LEED and other programs to support sustainable design. We believe that OLEDs will be readily received in the Brazilian market, and as with many new technologies, it will be important for costs of this emerging technology to decrease at a steady rate to enable the mainstreaming of OLED lighting in global markets. We continue to pursue efforts to gain greater understanding about key global markets and local tastes and preferences. ◂