LED professional Review

www.led-professional.com

ISSN 1993-890X

LpR

The Global Information Hub for LED Technologies and Design

Mar/Apr 2021 | Issue 84

Innovation United with Sustainability

I am particularly pleased to give you a short introduction to this new LED professional Review (LpR) release. We address some critical topics ranging from light sources to design aspects, communication subjects, and actual implementations in this issue. Inventions and technological progress are the basis for innovation. However, we also know that all developments – today more than ever – must be determined towards quality and, above all, sustainability. In this context, we were pleased to interview Mr. Hiroyoshi OGAWA, President and CEO of NICHIA. We also took the opportunity to send our congratulations on the occasion of NICHIA's 65th anniversary.

The topic of sustainability is complex and has many facets. One viewpoint is interchangeability, as prescribed by the new EU directives and discussed in the article about Replaceability. In cooperation with LightingEurope, we attained chief experts on UV-C disinfection, who provided us with the latest insights in this field. Wireless communication, and LiFi in particular, is a fascinating subject. Now, with standardization plans, there is further momentum towards market implementations. You will also find the link to the LiFi seminar from the International Solid-State Lighting Alliance published on LpS Digital in this release. In addition to all that, we present two specific new developments in the LED sector: New LEDs for outdoor applications and innovations in multi-chip LED packaging.

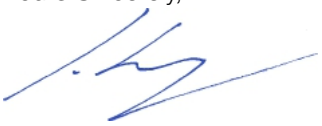
Smart Controls and Surgical Lighting articles complete the range of topics for technical developments and specific applications.

Finally, I would like to express my sincere thanks to all our contributors.

Enjoy your read and stay healthy!

PS: Call for Papers for the LpS Digital 2021 is open. Take the opportunity to submit your idea for a paper or present your latest innovations http://www.LpS-Digital.global.

Yours Sincerely,



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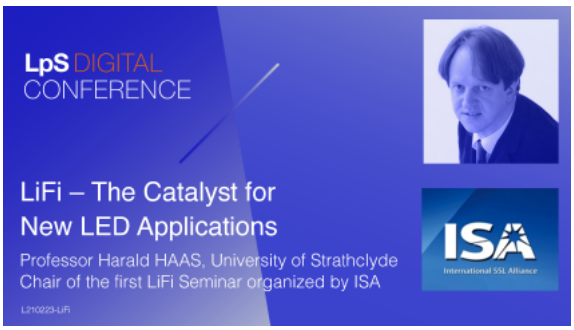
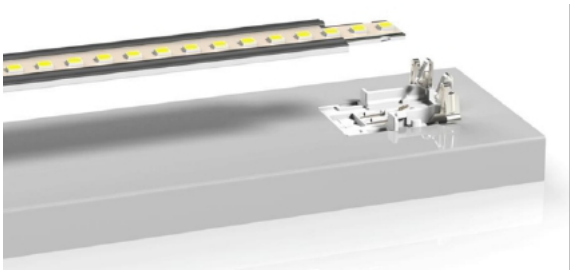


LiFi Seminar organized by the International SSL Alliance (ISA). State-of-the-art LiFi lectures including the keynote lecture by Professor Harald HAAS.

Hiroyoshi OGAWA



ADVERTISING INDEX

NICHIA Celebrates its 65th Year of Continuous Innovation – Hiroyoshi OGAWA, President and CEO of NICHIA

Hiroyoshi OGAWA
Hiroyoshi OGAWA is President and CEO of NICHIA Corporation. He has worked at the family business for close to 30 years. He graduated from the University of Tokyo.

Today, advanced LED technologies are essential in many areas, such as lighting, automotive, displays, horticulture, but also in the field of medicine and disinfection. NICHIA has pioneered today's LED technologies that have transformed so many industries and businesses around the world. This year marks the 65th anniversary of NICHIA's foundation. We were delighted to discuss NICHIA's history, achievements and outlook with the company's President and CEO Hiroyoshi OGAWA.

LED professional: First, we would like to thank you very much for allowing us to conduct an interview during NICHIA´s 65th anniversary celebrations. We would also like to congratulate you and NICHIA on your remarkable anniversary. It is only fitting that our first question is about NICHIA. Can you give us a brief history of the company, and your career?

Hiroyoshi OGAWA: Thanks for your interest in NICHIA. The business was founded in 1956 by my grandfather, Nobuo Ogawa, and this year is our 65th anniversary. After graduating from university in Tokyo, I worked for one of the major consumer electronics manufacturers in Japan for several years. When NICHIA decided to commercialize blue LEDs, I moved back to Tokushima to support my family´s business. Since then, I have seen how NICHIA´s LEDs have changed the world. While NICHIA is generally recognized as an LED company, my grandfather specialized in pharmaceuticals and chemicals, so NICHIA was purely a chemical manufacturer for its first 30 years.

Nowadays, NICHIA´s business consists of two core areas: optoelectronics products such as LEDs and laser diodes, and chemical products. NICHIA´s very first product was a type of calcium compound, which was a raw material in medicines and used limestone locally available in Tokushima. The company´s next phase was to develop phosphors. The combination of several calcium compound products brought NICHIA into this field.

Then, the quest for light led NICHIA to create the world´s first high-brightness blue LEDs and world's first white LEDs, and later laser diodes and UV LEDs. Meanwhile, in the field of chemicals – the company´s original business –the diversification from phosphors to cathode materials for secondary batteries and magnetic materials was achieved by using NICHIA´s core technologies of high-purity chemical synthesis and fine powder handling. In this manner, we have been expanding our areas of expertise for 65 years. When I look back through our history, there have always been obstacles and difficulties to overcome. However, we have succeeded in developing and commercializing many valuable products that can improve all of our lives. I am grateful not only to our customers, but also to our predecessors, employees, and everyone in the local community who has accepted and supported NICHIA.

LED professional: The culture and corporate philosophy are central building blocks of any company. What would you say is the essence of NICHIA?

Hiroyoshi OGAWA: Well, as a matter of fact we have a motto that all members in each office recite every morning: "Let´s study. Let´s think deeply and work hard. And let´s create the best products in the world." This sounds rather simple or straightforward, but clearly represents NICHIA´s corporate culture and leadership philosophy. In other words, NICHIA values the honest efforts of all employees. We work diligently to tackle challenges and grasp opportunities together as one team. NICHIA does not pursue short-term profit. While focusing on the fundamental essence of materials and technology, we pursue *honmono* – the best quality in the world. *Honmono* is a Japanese word that originally means something true, real or genuine; it also embraces products, work, manufacturing and people that are of the highest quality, professional and sincere.

> "*While focusing on the fundamental essence of materials and technology, we pursue honmono – the best quality in the world. Honmono (ほんもの) is a Japanese word that originally means something true, real or genuine.*"
>
> HIROYOSHI OGAWA

LED professional: NICHIA is the world leader in the LED business. How would you describe the recipe for success that has put NICHIA in front?

Hiroyoshi OGAWA: As I mentioned before, I believe that our success can be attributed to the continuous pursuit of development centered around the core root of materials and technology. We have maintained an honest and persis-

tent commitment to meeting the demands of the market, while still honoring our belief in and fundamental respect for true development and innovation.

LED professional: We would also like to address your product portfolio. How is the LED business segmented into product lines and geographical regions?

Hiroyoshi OGAWA: In terms of our LED portfolio, we segment the business into several categories, with three primary pillars making up the largest percentage of our LED business, all of equal importance to the company. First, there are LCD backlights for smartphones, tablets and so on. Then there are LEDs for automotive applications –the interior and exterior of vehicles.

Finally, LEDs for general lighting applications, which covers a wide range of commercial and consumer applications. Plus there are other fast-growing LED segments for NICHIA, such as UV LEDs, and stable markets, such as displays. While we do supply our LEDs globally, we focus on the main regions of Japan, China and Europe/Americas.

LED professional: The lighting industry has been undergoing a significant transformation since the transition to LED technologies. Also, there have been innovations through digitalization and connectivity. Where do you now see the main focus in lighting applications, and how should the lighting and components industries react?

Hiroyoshi OGAWA: LEDs have changed the light source market drastically. In spite of the opportunity presented by LEDs, there has been almost no change in the lighting fixture market for which LEDs are used. The entire lighting industry has still not moved on from the idea of simply replacing conventional light sources with LEDs. We would like to see the market take better advantage of LEDs, develop lighting spaces that are comfortable to all, and ultimately focus on developing lighting fixtures that can be achieved only with LEDs, not with conventional light sources. To achieve this ultimate goal, we will continue to pursue the ideal light source, form and quality.

It is essential to offer the type of value that has never existed before, for example in the form of health. As people are spending more time indoors –and especially during the global Covid-19 restrictions –there is a strong focus within the LED industry on commercializing lighting that can regulate the body clock, the so-called circadian rhythm. This is just one example of the value LEDs can bring that the industry can take advantage of. There are many more that we hope to see implemented, as the industry expands beyond simple replacements.

Figure 1: LEDs are widely used in displays ranging from large-screen applications to mobile devices such as smartphones

Figure 2: One of the main focuses of LED technology is illumination for the general lighting, automotive, horticulture and medical sectors

LED professional: Nowadays, the efficacies of white LEDs are at a very high level. Is there room for further developments?

Hiroyoshi OGAWA: While the discussion of LED efficacy has unfortunately been the dominant trend for the past decade, perhaps we should say it has almost matured, despite the many other significant benefits of LEDs. However, this trend of focusing only on efficacy has evolved over the last couple of years. While efficiency is of course essential, the discussion is now focused more on the combination of efficiency with a high quality of light, with implications for color rendering, or how things look under the lighting.

The function of light, for example to adjust circadian rhythm, has also been a focus. I believe it is still possible to improve efficiency in this context, both at the individual LED and system levels. For example, NICHIA´s newest mid-power general lighting packages, which we started introducing to global customers at the end of 2020, were developed for

a balance of color quality and efficiency. Utilizing the technology of our partner company, we eliminated the efficiency gap between 80 and 90 CRI.

We were able to commercialize a 90+ CRI LED with the same efficacy as the equivalent 80 CRI LED, which has garnered much attention from the industry, as this gap was a primary obstacle to implementing higher-quality light solutions. We will continue to strive for efficiency improvements paired with the quality of light and the function of light.

We will also work on research and development that has potential for technological innovations that realize further efficiency improvement, focusing on the true nature of light –that it behaves as a particle and as a wave at the same time.

LED professional: Since you have mentioned "quality of light" several times, could you tell us more about what this means?

Hiroyoshi OGAWA: For over a quarter of a century, since white LEDs began to revolutionize the lighting market, the most important theme has been efficiency. To replace the conventional light sources that had already been widely adopted in society over many years – equivalent efficiency at least, or preferably even better efficiency – was required.

In addition, the power shortages caused by the 2011 earthquake in Japan and the resulting Fukushima nuclear power plant accident became a major trigger for the penetration of LEDs in the lighting field: "efficiency" and "energy-saving" were seen as their primary advantages. However, for that reason, perhaps too much emphasis was put on efficiency, and LED lighting may have sacrificed the color rendering properties and the natural appearance of colors that had been achieved with many fluorescent lamps and halogen bulbs.

As I mentioned earlier, it is now time to turn our attention to the quality of light with LED lighting, given that efficiency has reached a point of maturity, and while our lifestyles have been forever changed by Covid-19. One of NICHIA´s solutions is a product I highlighted before, which achieves excellent color rendering and efficiency simultaneously. Additionally, NICHIA´s development of LEDs with an emphasis on circadian rhythm is an achievement that addresses this pursuit of exceptional light quality and light functionality.

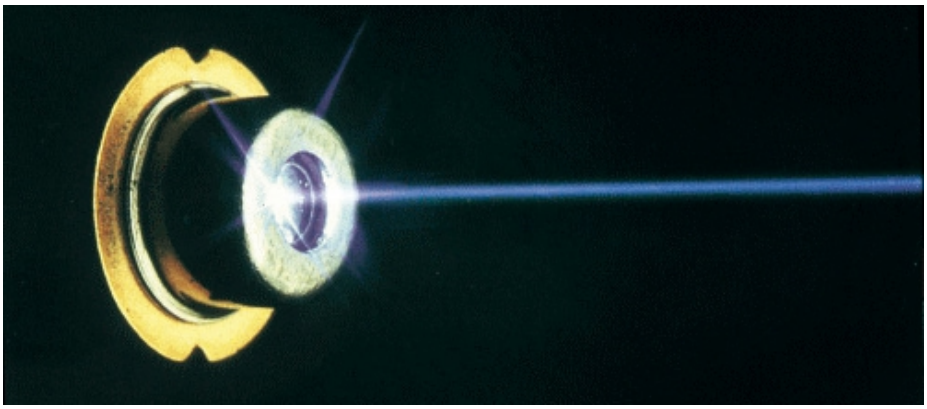


Figure 3: Laser technology is considered one of the next big and future steps in innovation

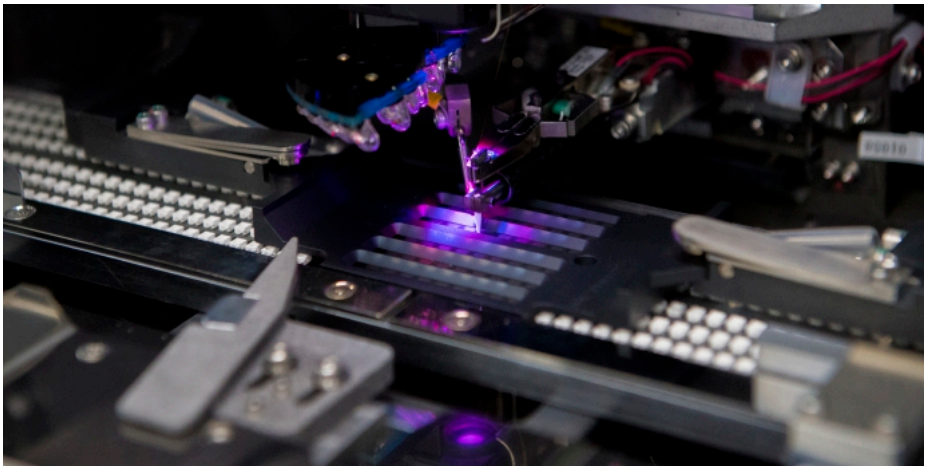


Figure 4: Quality aspects are a central part of the LED mass business, especially with regard to failure rates, color rendering quality and life time

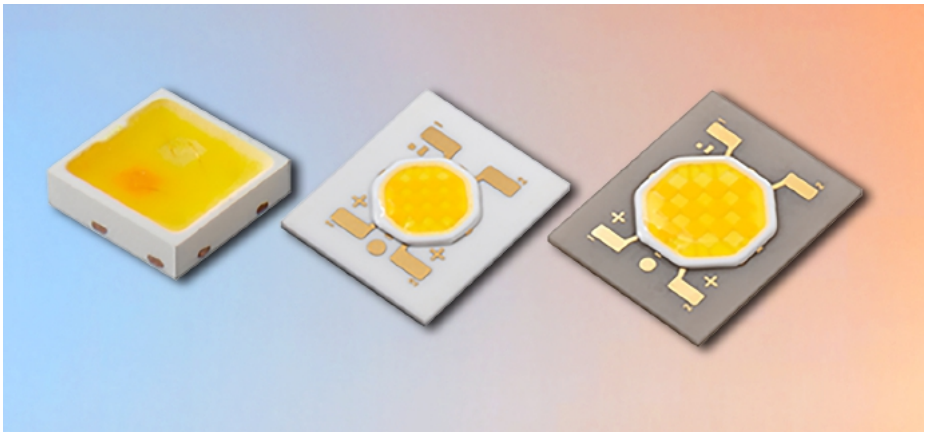


Figure 5: Today's mass LED business is primarily built on phosphor-based white LEDs, which are highly optimized in terms of spectral properties

While we increasingly work from home and stay indoors for a greater period of time, we need to continue to pursue the provision of light that makes our surroundings look more natural, colorful and uplifting. Lighting that brightens a person´s face in person or via virtual meetings results in a more lively conversation. It is important to enrich our lives with light that energizes our soul and soothes our body as we rest each day. By harnessing all the expertise from LEDs and phosphors cultivated over many years, NICHIA is in a position to deliver a quality of light that has never existed before.

Hiroyoshi OGAWA

LED professional: UV LEDs, and especially UV-C LEDs, are the next big topic and the hope for extending the business. Are there any updates you can share with us about this product group?

Hiroyoshi OGAWA: Certainly, the UV-C area is attracting attention due to the Covid-19 pandemic. I think UV-C LED is important technology both in terms of contributing to society, and new business possibilities. NICHIA has been a leading supplier of UV LEDs for over 20 years, although the primary success has been in UV-A markets, specifically for resin curing and sensors. However, as the performance and lifetime have improved, interest in and expectations of UV-C LEDs, especially with regard to sterilization, have increased –this was the case even pre-pandemic.

Now, Covid-19 has further boosted that interest in and expectations for UV-C LED solutions. Unfortunately, as UV-C technology is still in its infancy, the market has been flooded with many unreliable, low-performance products. NICHIA believes that it is critical to develop strong and reliable UV-C LED solutions that take advantage of the germicidal benefits of the technology, but without sacrificing reliability. Just in the past quarter, NICHIA has commercialized two industry-leading UV-C LEDs that succeed in combining high performance and a long lifetime. We know the future for UV LEDs remains strong, and we are excited to continue expanding our portfolio. We are honored to have our products utilized in new fields, contributing to a safer and more secure society.

LED professional: NICHIA has very successfully introduced products in general lighting, automotive lighting, displays and UV to the market. What strategic product directions can we expect from NICHIA in the future?

Hiroyoshi OGAWA: In 1993 NICHIA transformed the world with an innovation that would forever alter the global energy landscape –the invention and commercialization of the blue LED, soon followed in 1996 by the white LED. While this transformation has meant a lot to the industry and the world, as I previously mentioned, I fear we are not fully taking advantage of the technology and what it has to offer. Most of the LED lighting that has emerged in the last quarter-century has, in my opinion, been simply replacing conventional light sources.

Of course, those replacements were meaningful, and I am proud that it has contributed significantly to society in terms of energy-saving and other aspects. Still, we as an industry can do so much more. As of today, we will re-examine and pursue the true essence and purpose of LEDs, as well as laser diodes, another core pillar of NICHIA´s optoelectronics business. We will introduce revolutionary light sources for lighting, automotive and other applications in terms of design, function and quality of light, which only NICHIA can achieve.

LED professional: Sustainability is a key topic that affects us all. How does NICHIA address this issue in general, and specifically for products?

Hiroyoshi OGAWA: First and foremost, by increasing the efficiency of LEDs and improving the efficiency of production processes, energy consumption and carbon dioxide emissions can be greatly reduced. Also, waste and maintenance costs can be reduced by extending the life of LEDs. Making contributions to society through actions like these is central to our sustainability efforts. Moreover, we provide a comfortable and safe work environment for employees, and

Figure 6: Located at the foot of the Yatsugatake Mountains, overlooking Suwa Lake, the Suwa Technology center is the development base for advanced products

Figure 7: One of NICHIA's several huge production facilities in Japan (Tatsumi-Plant in Tokushima)

we avoid environmental pollution within NICHIA and our supply chain. The use of renewable energy in running our business is also central to our ethos, which is why we are installing solar power generation systems in our plants.

LED professional: We are living in challenging times. With that in mind, what visions for the lighting sector will guide you and NICHIA in the coming years?

Hiroyoshi OGAWA: Again, one area of focus is in the UV field, as sterilization becomes increasingly important to control the spread of Covid-19. We are also considering the fusion of UV and general lighting. "Health" remains an essential trend. The quality of light and the role of lighting will remain critical in the future, especially as lifestyles change. People are likely to spend extended time at home, in an artificial lighting environment, and this will in turn disturb circadian rhythms. Our introduction of the "Light so Good" portfolio includes several different solutions to address these key challenges, including Optisolis™ [1], Vitasolis™ [2] and our game-changing 2-in-1 tunable white single LES LED. Additionally, with the elimination of efficiency gaps with 90+ CRI, NICHIA is continually proving itself as an innovation leader. We will strive to make a continuous contribution to improving the quality of life for wider society and our personal wellbeing.

LED professional: In the last part of this interview, we would like to ask you about business in Europe. In recent years, a very strong applications and sales team has been established in Europe. How important is design-in service for customers, and what strategy will NICHIA pursue in this area in the future?

Hiroyoshi OGAWA: As you know, for both automotive and general lighting applications, cutting-edge technologies are often generated within Europe and deployed worldwide. Therefore, we would like to contribute through the development of new technologies and new products from those initial stages, so that we can have the opportunity to create new products together with our customers and promote them all over the world. To achieve this, we have been making significant investments in the sales and applications teams in Europe. Design-in activities in Europe have strategic importance for the LED business of NICHIA globally.

LED professional: In addition to serving its key accounts, NICHIA has excellent long-term relationships with major distributors. What future progress do you anticipate?

Hiroyoshi OGAWA: Since the era of phosphors for fluorescent lamps and TVs (before our LED business even started), NICHIA has persevered with a direct business model. We worked very closely with our customers so that we could respond to their needs directly and develop the market accordingly. However, over time, as LEDs have drastically changed the lighting landscape, we have modified our European sales model to work with distributors for certain customers, while also maintaining direct business with others.

In 2011, we started working with local European distributors with a strong regional presence. In 2016, after further recognizing the value that distributors bring, we started working with a key global distributor in addition to our network of local distributors. These are all great assets to NICHIA and complement our business strategy.

Given the current situation, it is not possible to interact with the whole LED lighting market by relying solely on communication with key accounts. Therefore, distributors help NICHIA to better understand customer needs, and direct us to take the best possible action. Indeed, they offer a market reach that is far greater than NICHIA [3] could deliver directly. Thanks to their cooperation, NICHIA´s name has become better known to small and medium-sized customers as well as designers, specifiers and end users.

Our relationship with distributors has grown further through collaboration on technical seminars, product promotions, webinars, exhibitions and successful joint projects with customers. By harnessing these activities we will continue to serve the market´s needs with relevant technological innovations.

LED professional: We would like to thank you very much for your time, and for giving us a glimpse into your company´s workings. We wish you and your family, and all your employees and their families, the very best for a successful and bright future.

Hiroyoshi OGAWA: Thank you very much. ■

Figure 8: One of NICHIA's R&D centers in Japan (Kanagawa Prefecture)

References

[1] https://www.nichia.co.jp/en/product/led_sp_optisolis.html
[2] https://www.nichia.co.jp/en/product/led_sp_vitasolis.html
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