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**The first techno-business conference on phosphors was recently hosted by Intertech in Scottsdale, Arizona. With international support from both speakers and attendees, the conference provided a good overview into the use, development and manufacture of phosphors for a wide range of uses provided by some of the leaders in this field. With over 130 in attendance, users, manufacturers and research groups were well represented and provided an informative forum for those present.**

# Is there a phosphor in your future?

Phosphors are widely used in the developed world. The two main application categories are CRTs (such as television tubes, instrument and PC monitors), and fluorescent lighting with other lower volume application volumes including fluorescent screens and high resolution image transfer. There are also developing technologies and market applications for phosphors such as plasma displays (some large screen TVs), field effect displays (also large screens), electroluminescent displays and phosphors for white light LEDs. But most of these do not have well established markets and have their growth restricted by well established competitive products. The two largest volume applications are CRTs with an annual phosphor consumption of about 10,000 tonnes per year and fluorescent lamps with a consumption of about 4,000 tonnes per year. By comparison, the other use categories are low volume applications with a few tonnes or less being used per year.

However, one of the largest compound semiconductor growth markets, white-light emitting diodes WLEDs (a segment of the high brightness group), depends almost entirely on phosphors for white light generation by combining blue LED light with a 'yellow' phosphor. Although there are other ways to generate white light from LEDs to supply to huge potential of this market, (e.g. the combination of red, green & blue LEDs) it would appear that from today's perspective the phosphor/LED combination (now looking at the use of more than one phosphor to provide better colour rendition) will always be a significant share of the LED-generated white-light market. First-generation white LEDs have mostly used existing phosphors and dispersion resins for their manufacture, but the range of LED wavelengths that are

## The single UK player

In 1996 an Esprit research project in Europe involving Thomson-CSF LCR (F) (Coordinator), Phosphor Technology Ltd (UK), Philips Research Laboratories Aachen (D), Thomson Tubes Electroniques (F) and TU Delft (NL) aimed to develop improved phosphors with characteristics optimised for large size flat Plasma Display Panels (PDPs) for future consumer TV and professional applications. A key point of the project was to ensure European availability of improved PDP phosphors and display devices containing them.

Phosphor Technology Ltd was then involved in the development and scale-up of improved red, green and blue phosphors aiming to maintain large scale production of the developed phosphors and to consolidate its position as a major supplier for these improved materials.

Major competition apparently sources from China, Russia and Japan.

In 1998 PTL achieved certification to BS EN ISO 9001 and is now a leading developer and manufacturer of inorganic luminescent materials used in displays, radiation imaging and detection, laser alignment, security, anti-counterfeiting and a wide range of other applications. Products using its materials include CRTs, FEDs, PDP, X-ray, IR, UV scintillation and laser detection.

Based at Nazeing, in Essex PTL is to move into newer, larger premises in Stevenage, Hertfordshire

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Courtesy: www.ph-freiburg.de/chemie/

being developed as white LED drivers (using blue to ultraviolet wavelengths) will require new breeds of resins and phosphors for efficient light generation that are designed for this specific use.

The phosphor industry is different from most industries, with fewer than ten companies supplying most of the world requirements and many of these use their own closely held technology for the end product manufacture.

The present LED market may be of little interest to the established industry because of its small size, a few tonnes.

Thus, it is possible that the demand for many new phosphors with different excitation and emission wavelengths, particle sizes and stability needs from the WLED could spawn a new breed of phosphor manufacturers, especially since the solid state chemical and milling methods used for the manufacture of the large-volume phosphors do not appear to be ideal for LED applications.

And, if the white LED reaches its anticipated potential in five or ten years, then kilo-tonne quantities of special particle phosphors would be the order of the day and one of these products will be part of your future.

As compound semiconductor technologists, we will need to support more rare earth chemistry and keep an eye out for new phosphors coming our way. New advances in this field will be needed to realize the future potential of the WLED.
*Dr Alan Mills, contributing US editor reporting from Scottsdale.*

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