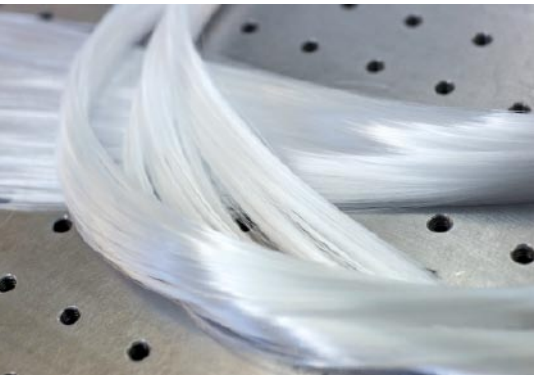
Symphony of Lights

From Fiber Optics to High Power LED Ring Lights

Light is an important foundation for all cultures, for it allows people to enjoy a safe and pleasant life. Controlling light and making it technically useful continues to present a complex and challenging engineering task even up to the present day. This includes generating, shaping, diverting, converting and measuring light. Without optimized lighting, even modern automation technology remains blind, which is true for optical inspection applications and image processing, as well as for endoscopic applications.

Different tasks require different illumination concepts. What sounds quite obvious can in reality often be a difficult decision for users, when it comes to choosing between the necessary light intensity, on the one hand, while at the same time considering the illumination frequencies, qualities of the surfaces being illuminated and, last but not least, the reliability and longevity of the light source. Working out customized solutions for specific applications is considered to be the core strength of Volpi, located in Schlieren, Switzerland. The company specializes in the development and production of fiber optic and optoelectronic components as well as custom OEM solutions, particularly in the fields of medical technology, automotive, testing technologies and machine vision.



The glass fibers for the fiber optic illumination systems are produced by Volpi; the company also uses them in sensor technology

Fiber-Optic System or LED Illumination?

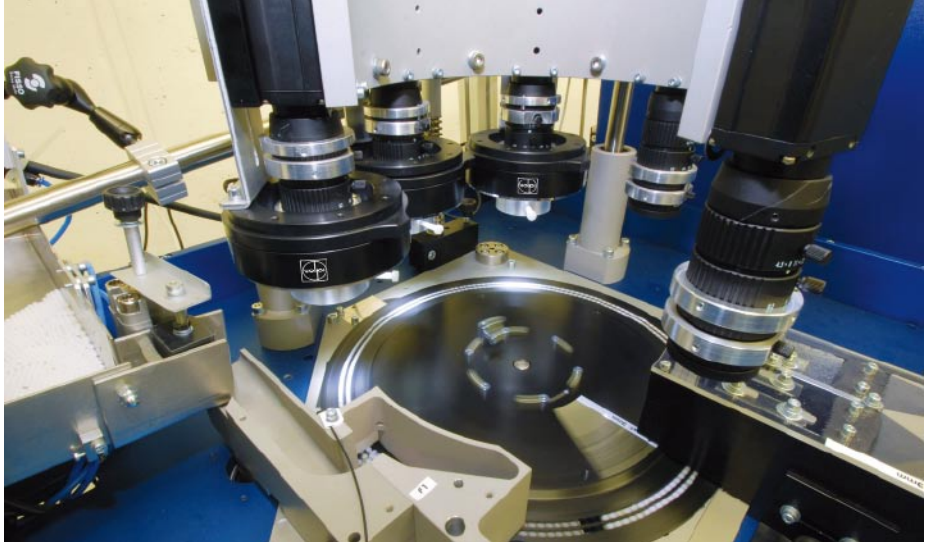
While fiber-optic illumination systems have in many areas been eclipsed by LED technology, they still remain the first choice for numerous applications, such as when temperature-critical objects must be further away from the light emitter and the light must bridge large distances or needs to be provided in areas where there are high electrical charges. In these situations, fiber-optic ringlights give a homogeneous and shadow-free illumination of the work surface. Flexible light emitters are well-suited for illuminating hard-to-reach objects in confined spaces or over large distances. In order to connect to cold-light sources there are also special fiber-optic background light fields, useful when it is necessary to perform precise measurements in transmitted light mode. Fiber-optic line lights offer a practical illumination solution for inspecting surfaces with line or area scan cameras.

Today, however, LED lighting systems are taking on a more dominant position as a result of their high efficiency and low power consumption. The same is true for traditional fiber optics applications for which LED light sources are increasingly being used. Volpi is one of the first manufacturers to have developed an LED light source with high-power LED technology. For machine vision applications, this means that the homogenous light distribution so typical of fiber optics can be combined with the economy and longevity of LEDs.

Today, proven standard products are available for a great variety of tasks requiring LED lighting systems: Coaxial illumination is suitable, for example, for objects with reflective or highly reflective surfaces. LED line lights from Volpi offer a good degree of uniformity and ho-

Inspection Systems by Systron

Situated in Birmersdorf, Switzerland, Systron develops and builds inspection systems that are customized to the customers' needs. These include stand-alone systems as well as systems that can be integrated directly into automation lines. The main focuses of development here are image processing, the design of lighting and optics as well as the appropriate PC software and control systems.



Automatic inspection system for surface and dimensional inspection of glass, plastic and metal spheres; camera systems inspect the entire sphere surface

The new four-segment LED ringlight provides homogeneous, shadow-free incident light in high contrast

mogenous illumination all the way to the line edges. Diffuse dome lighting is ideal for illuminating non-reflective or low reflective objects, without causing shadows. LED dark field illumination is excellent for emphasizing edges and elevated structures on objects. LED background or transmitted light illumination is preferable for measuring or testing contours. LED ringlights provide the perfect conditions for microscopy and machine vision applications.

LED Ringlight in Action

The new, fully automated Uranus-S inspection system for spheres developed by Systron is a good example here. The system is well-suited for many different applications in the pharmaceutical and cosmetic industries all the way to automotive production. A new, adjustable-focus 4-segment LED ringlight from the Volpi product portfolio provides the right illumination for inspecting the surface and dimensions of metal, plastic and glass spheres with diameters ranging between 1.0 and 3.5 mm. Its 12 white high-power LEDs, which can be controlled in four segments, provide homogeneous, shadow-free and especially bright incident light. In addition, the ringlight can be easily modified to meet the requirements of the particular sphere inspection system.

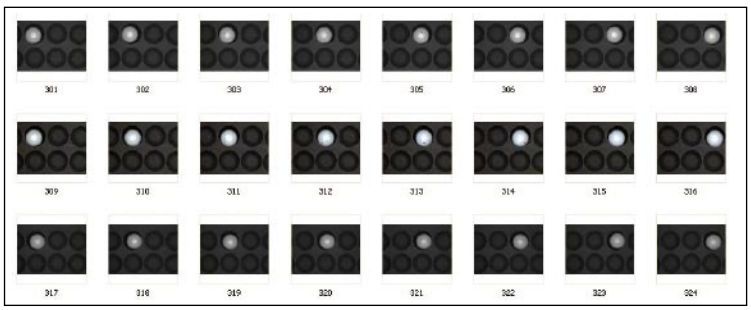
Before testing, the spheres are ionized in the intake basin. From there, they pass in batches to the perforated disc in the testing compartment. During the optical inspection, each of the three camera systems takes eight images of each sphere while it is being rotated in order to inspect the entire surface of the sphere. Thus, 24 image acquisitions are made from each part. This allows any damages from the smallest scratches all the way to cobble, casting and sanding defects to be reliably detected. A fourth camera tests the diameter and any potential eccentricity of the spheres. An additional camera monitors the good/bad sorting to the reject container. The throughput of the inspection system depends on the particular application and can be set for between eight and 16 parts per second. Modifying the system for other sphere types is quick and easy to do.

Flash Mode Increases Luminous Efficacy

The flexible inspection system, which is suitable for spheres of the most diverse materials, colors and finishes, demands quite a bit from the technology used. "We depend on extremely high-performance solutions for camera systems and illumination," reports engineer Stefan Ubezio, CEO of Systron. "The focusable LED ringlight from Volpi fully meets our expectations here." The focusing optics makes it possible, for example, to have variable working distances or to easily modify the system for different part sizes.

But beyond this, the illumination during the sphere inspection must meet an entire range of additional requirements. After all, it is no trivial task to provide the right illumination of small, moving objects made of various materials for the purposes of image acquisition. "You can virtually never have enough light," Ubezio summarizes the situation. "We therefore designed the control of the ringlight in such a way that it flashes, i.e. illuminates for 500 µs in order to provide the ideal illumination for each camera shot; the LEDs then have a break for about 50 msec. This allows us to achieve luminous efficacy four times greater than in continuous mode. This also results in less waste heat, which in turn increases the life expectancy of the LEDs." Ringlights have a typical life expectancy of at least 10,000 operating hours at 100% intensity and in continuous operation, meaning that they have a very long service life in the first place.

The sphere inspection system detects diametrical deviations from 0.01 mm, eccentricity from 0.02 mm and surface imperfections down to 0.05 mm. Without the LED ringlight, these microscopically small deviations would not only be invisible to the human eye – but to industrial cameras as well.



The logging function of the Uranus software makes it possible to display and save the 24 pictures used for inspecting the surface

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