United Nations Educational, Scientific and Cultural Organization

International Year of Light 2015

OSA Università degli Studi di Messina Student Chapter

Young Minds Messina

International Year of Light 2015

Appunti di Fisica '15
&
Dottorato di Ricerca in Fisica

20 maggio ore 15:00
Aula Majorana,
Dip. di Fisica e di Scienze della Terra

The invisible light:
An industrial application of infrared microscopy.

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Optical microscopy is an ancient science that has enabled important discoveries in various fields of research with implications that range from technological aspects to the life sciences. Despite his age, light microscopy is not affected by the effects of time, still is a technique widely used in various fields of research and it is the subject of innovation and improvements. It allows to image the amazing world of the small things from a lot of different points of view.

An almost unknown aspect of microscopy is the possibility to use the infrared light that is invisible to the human eye but allows, in many cases, to obtain unusual images and important information. The first to use it was August Kohler in 1891: he used photographic plates to obtain images of objects illuminated with infrared light. Today to observe the infrared radiation a number of different sensors are available, they often are developed *ad hoc* according to the infrared region to be observed. These sensors use different technologies but all of them have a rather long response time: usually of the order of tens of milliseconds. These features are enough for the thermal diagnostics of building and offer a non-invasive diagnostic method to the industrial electronics.

In the last years, the electronics industry hardly worked to develop devices suitable to improve the efficiency. An example is the automotive where today the power devices play a key role, but they will become the first players when the electric vehicles will be a

standard. Obviously, the massive presence of electronic devices also implies an improvement of the reliability; its evaluation is one of the unexpected aspects of infrared microscopy: studying the thermal distribution on the devices surface during the cycle of operation it is possible to predict the average lifetime of the devices (Coffin Manson law). This very special thermal analysis, however, cannot be done using conventional techniques due to the very small width of the current pulses to which the devices undergo. They are very short pulses: the complete cycle time is often reduced to the millisecond and a study with a classic infrared sensor would result in an average of the thermal distribution, useless for the evaluation of reliability. An unconventional infrared microscope has been developed; it is able to map out the area of the device with a frame time well below the millisecond. This technique also provides interesting information for designers in all those devices where a control logic and protection against overload is embedded.