

## An early warning system for light damage in museums and exhibitions

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Light is one of the most powerful parameters in altering colour and so causing irreversible damage in works of art.<sup>1</sup> Actually, it is by now widely recognised that several photo-induced deterioration mechanisms are enhanced, or accelerated through a co-operative action, by different physico-chemical factors (temperature, relative humidity, pollutants).<sup>2,3</sup> However it is quite clear that works of art cannot be appreciated without light, so a compromise has to be found that can balance visitor's requirements and object's safety. It is known that the damage increases with the length of exposure and the irradiance. Rather than limiting the time of exposure for each object, it is advisable to monitor the lighting conditions on site. A continuous monitoring program for a number of objects with data loggers would be rather expensive and applicable only for selected examples. As an alternative for extensive measurements, here new light dosimeters, **LightCheck? Sensitive** (LCS) and **LightCheck? Ultra** (LCU), are proposed as an early warning system for light damage. These dosimeters can fill the present gap created by the lack of suitable materials to detect low to medium values of light doses. Actually, the well-known Blue Wool Standard, in its most sensitive formulation N. 1, is suitable only for light doses of the order of several hundred of Kluxh.<sup>1</sup> **LightCheck®** is a product developed within a project partly funded by the European Commission (Key action "The City of Tomorrow and Cultural Heritage", reference EVK4-CT2000-00016). The two dosimeters consist of photosensitive dyes, applied on a substrate with a polymer binder. Their response to light is cumulative, as they undergo a progressive variation in colour with increasing exposure. Clearly discernible colour steps are reached depending on the dose of light received, so that the dosimeters can be used for a first, instrumentation free, easy and fast estimation of the luminous exposure that an object receives in a given environment during a given period. The working principle is quite analogous to the one of pH indicator papers: the colour of the exposed dosimeter is compared to the one of a properly calibrated scale so as to get a semi-quantitative information on the total light dose received during the exposure period. The exhaustive work carried out for the elaboration and characterisation of **LightCheck®** dosimeters led to the definition of their respective field of application. In fact, LCU and LCS can be used in a complementary manner because the former is especially suitable for the monitoring of very-light sensitive and fugitive objects, usually exhibited under low levels of light (ISO categories 1-3; e.g. color photographs, watercolors, textiles, natural history specimens), or for short exposure periods, while the latter is better suited for controlling the lighting of more durable objects (ISO category 4-6; e.g. oil paintings, tempera, polychrome sculptures, bone, ivory) or for longer exposure time.

- 1) T. T. Schaeffer, "Effects of Light on Materials in Collections" - Series : Research in Conservation, (2001) , Ed. Getty Publications, Los Angeles , California.
- 2) J. Tétreault, " Airborne Pollutants in Museums, Galleries, and Archives: Risk Assessment, Control Strategies, and Preservation Management", Canadian Conservation Institute, 2003.
- 3) M. Bacci, C. Cucci, A. A. Mencaglia, A. G. Mignani and S. Porcinai, Studies in Conservation, 49 (2004) 85 – 98.