VIDEO ARTICLE

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Chromogenic Solid Materials Based on Polymeric Micro/Nanocapsules

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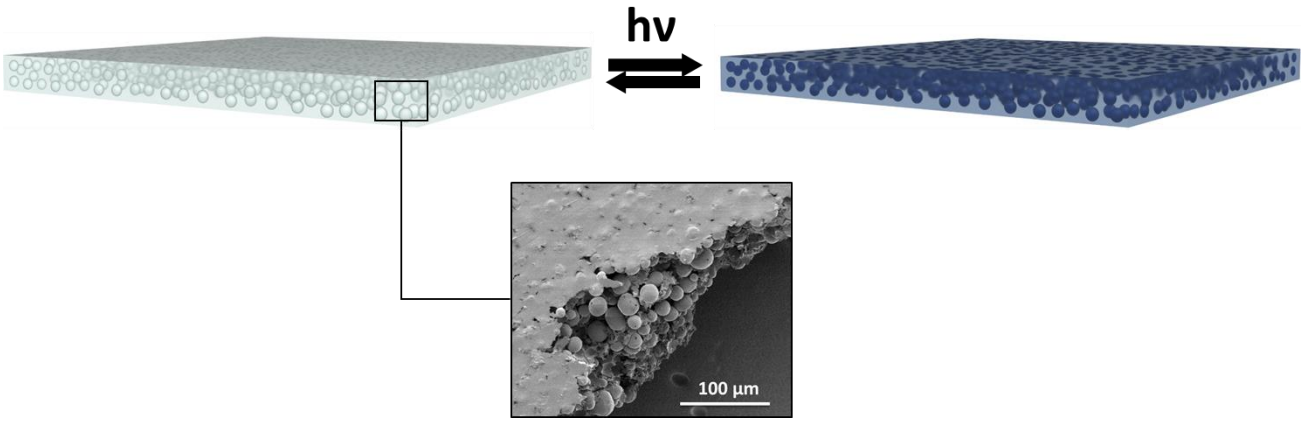
Graphical Abstract



Abstract

Photochromic materials undergo reversible colour change when exposed to radiation. To date, this phenomenon is already industrially applied as photoprotective coatings in ophthalmic lenses and smart windows.1 However the reversible variation of the absorption/emission properties upon irradiation could be exploited to control input/output optical signals in logic gates, information recording/processing and rewritable devices.2 Therefore the development of novel and high-performing photochromic materials is of growing interest in both academic and industrial research. Most of the mentioned applications require solid substrates (e.g. polymeric matrices) embedding the photochromic system, which often consists of organic photochromic molecules (e.g. spiropyran and spirooxazines) that interconvert between two different states that display different absorption properties and colours. These molecules have been synthesized for many years and their behaviour is generally well-known and controllable in bulk liquid solutions. However, when these are embedded in solid materials, their photochromic responses (e.g. absorption in the dark and irradiated state, interconversion rate, etc.) become less controllable, or even inhibited because of the surrounding matrix. Therefore, it is required to adapt the photochromic materials to make usable in solid matrix.

In this talk it is showed the general strategy recently developed in our group to respond to this challenge and obtain controllable and tunable photochromic response in the solid state. This is accomplished by using core-shell micro/nanocapsules, containing solutions of the photochromic dyes. By simply modifying the core material of the capsules, we are able to make photochromic materials of completely different behaviours: from very fast-responsive photochromic films,3 activated by UV radiation (positive photochromism), to tuneable visible-light responsive materials, that reversibly discolour upon irradiation (negative photochromism).4,5 This approach employs commercially available starting materials and avoids chemical modifications of the dye and/or the matrix that increase the production cost and prevent scalability. It will be showed how these photochromic films are promising materials with potential application in dynamic glasses and lenses, or for visible-light activated rewritable devices and anticounterfeiting technologies.

Keywords: Photochromism; encapsulation; polymer micro/nanocomposites.

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Biography of Presenting Author

Claudio Roscini obtained his master's degree in physical chemistry at the University of Perugia, in Italy. Successively he moved to Bristol University (UK), where he received the Ph.D. in chemistry (2010). After a postdoctoral period at the Autonomous University of Barcelona, during 2011-2013 he got involved in industrial research projects related to nanotechnology at the Technology Institute Fundació Privada ASCAMM (Barcelona). Since 2013 he works at the Nanostructured Functional Materials group at the Catalan Institute of Nanoscience and Nanotechnology (ICN2), where he leads the research line of chromogenic and emissive solid materials for energy-efficient devices. Currently he is involved in both academic and industrial projects related to the development of organic micro/nanostructured optical materials that respond to external stimuli, such as temperature and light (e.g. photo/thermochromic, upconverting, NIR-responsive materials). In his research he seeks for converting new fundamental findings into prototypes that could find real applications. In June 2014 he became co-founder of a spin-off company, Futurechromes S. L., aimed to obtain a new generation of fast-responsive photochromic materials, based on a previously patented technology. In 2020 he became part of the editorial board of the journal Dyes and Pigments.

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