Photochromic and plasmonic hybrids: mutual control and benefits

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Using photochromism to modulate photophysical properties such as fluorescence is very promising for applications because it offers time and space control. Moreover, metallic nanoparticles have been widely used to enhance molecular photophysical properties due to surface plasmon polaritons. Thus the idea of coupling photochromic unit and plasmonic unit is very interesting and for exemple Feringa and co-workers [1] showed that such hybrid materials could be used to induce a switch of the molecular conductance by light excitation. But such a coupling between these two units is still improperly known: it can lead to a decrease of the photochromic activity [2], an irreversibility of the photochromic reaction [1] or an improvement of the photoswitching efficiency [3]. These backward issues are explained by the crossed influence of the photochromic unit with the plasmonic unit.

Here we present different experimental results of hybrid systems showing the mutual control between plasmonic and photochromic units and the benefits that can be obtained. We will see how the photochromism can modulate the plasmonic properties and how the gold unit can influence the photochromic reaction. Controlling such cross-talking interactions is complex and many key parameters have to be taken into account.

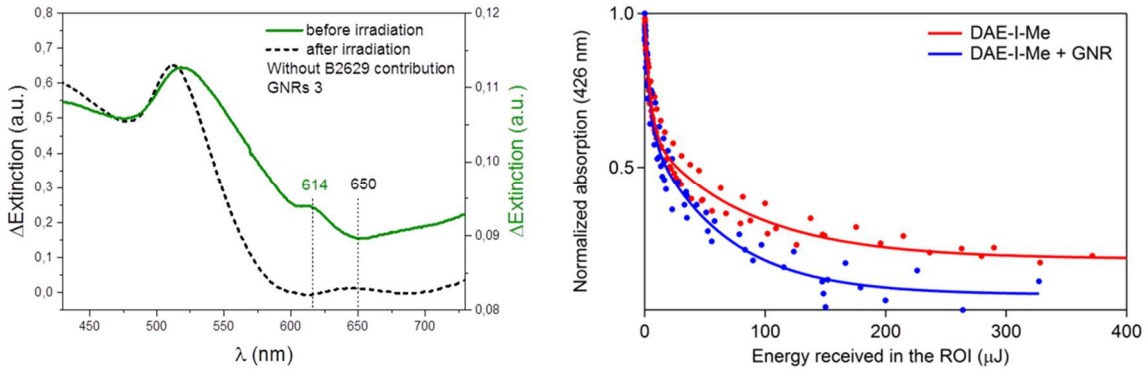

Figure 1. Left, modulation of the plasmonic bands with the photochromic reaction. Right, enhancement of the photochromic back reaction due to gold nanorods.

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[2] H. Yamaguchi, K. Matsuda, M. Irie, J. Phys. Chem. C 2007, 111, 3853.

[3] H. Nishi, T. Asahi, S. Kobatake, Phys. Chem. Chem. Phys. 2012, 14, 4898.