Nanooptics and photonics (or Nanocomposites and nanomaterials)

Effect of gold nanoparticles on photochromic furan-based diarylethenes

Iu. P. Mukha[1], S. V. Snegir[1], A. A. Khodko[2] and N. M. Kachalova[2]

[1]*Chuiko Institute of Surface Chemistry, NAS of Ukraine, General Naumov Str. 17, Kyiv-03164, Ukraine. E-mail: iu.mukha@gmail.com*

[2]*Institute of Physics, NAS of Ukraine, prospect Nauki, 46, Kyiv-03039, Ukraine. E-mail: khodkoalina@gmail.com*

The photochromic molecules that can be reversely switched between two well-defined open-ring (OF) and closed-ring (CF) forms by external optical and/or electrical stimuli attract much attention [1], since these molecular switchers can be connected to the metal nanoparticles, while construction of optoelectronics organic elements [2]. However, the unclear effects such as the inhibition or the acceleration of switching by surface plasmon resonance, which underlie the reversible photochromic molecule-metal switching [3], are critique for further applications.

In this work, we studied the interaction of photochromic furan-based diarylethene derivatives with gold nanoparticles (Au NPs) in water-ethanol solution by UV/vis spectroscopy. Here we used citrate-capped Au NPs and π-conjugated thiosemicarbazone (TSC) and methylthiosemicarbazone (MTSC) molecules synthetized at the University of Konstanz (Germany) [4].

TSC and MTSC molecules interacted with nanosized gold in open-ring and closed-ring states and in both cases caused aggregation of nanoparticles, stronger in case of OF. Changes in absorption spectra of solutions were accompanied by dramatic color change from pink to blue. The second plasmon resonance band of gold appeared as a shoulder and then as maximum at 650-700 nm that was due to the excitation of plasmon resonance along the long axis of gold, known as the longitudinal plasmon band. We identified the optimal concentration in solution required for stability of Au NPs/TSC (MTSC) systems and analyzed the effect of functional end-groups of diarylethenes on photochromic reaction.

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