Nanoplasmonics and surface enhanced spectroscopy

Plasmonic control of light in thin film solar cell absorbers

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Development of electronic components deposited on the thin flexible substrates looks very attractive. Flexible thin film solar cells could be based on thin amorphous films: amorphous silicon, copper indium selenide, copper indium gallium selenide, cadmium telluride. Light absorption is proportional to the thickness of the film. It is important to find the ways to keep and control an acceptable light absorption for thin solar cell absorbers. Addition of noble metal nanoparticles to the solar cell absorber allows to enhance light absorption of the layer at certain spectral range without essential changes in its thickness.

Resonance light induced oscillations of surface electrons in metal nanoparticles result in nearby local concentration of light energy and electric field [1]. Thus light absorption in semiconducting film near the metal nanoparticle can be locally enhanced. We decided to check this possibility on the example of $CuInS_2$ material modified by gold nanoparticles. Precursors of these compounds were sprayed on the hot substrate in different sequences to check top and bottom variant of placing gold nanoparticles relatively to the $CuInS_2$ layer. It was revealed that chlorine containing in the gold precursor destructively influence on the $CuInS_2$. Therefore procedure at which $CuInS_2$ is deposited on the preliminary formed gold particles is more prospective. In this case we received 2 times plasmonic enhancement of light absorption in the spectral range 650-700 nm by the $CuInS_2$ film deposited over the gold nanoparticles. This work was financially supported by the projects: TK114 “Mesosystems: Theory and Applications” (3.2.0101.11-0029), AR12118 “Efficient plasmonic absorbers for solar cells” (3.2.1101.12-0023) and IUT 19-4 and Marie Curie ILSES project no. 612620.

1. *Atwater H., Polman A.* Plasmonics for improved photovoltaic devices // Nat. Mater.-2010.-**9**.-P. 205-213.