# Plasmon enhancement of performance of photosystem I based biomimetic graphene solar cells

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We present plasmonic enhancement of optical and electrochemical performance of bio-inspired electrodes for solar cells. In our construction robust photosystem I (PSI) complexes isolated from red algae *Cyanidioschyzon merolae*, characterized by quantum efficiency of photoinduced charge separation close to 100%, are interfaced with graphene. This atomically thin hexagonal lattice of carbon is an efficient energy and electron acceptor [1]. We have previously shown that by chemical modification of graphene with nitrilotriacetic acid (NTA) followed by binding of cytochrome (cyt) c553, it is possible to obtain uniform assembly of PSI, which facilitates directional charge flow leading to its improved electrochemical performance [2].

In the present work we demonstrate that coupling of PSI-based electrodes with a metallic nanostructure – silver island film (SIF) prepared both on conductive FTO substrates and on glass coverslips – leads to strong modification of their optical properties. In particular, it results in significantly enhanced PSI absorption efficiency, as evidenced by the results of fluorescence microscopy. This strong improvement (characterized by enhancement factor of 15) is found especially in absorption of green light, which is rather poorly absorbed by native PSI complexes. Electrochemical analysis proved that incorporation of the plasmonically active nanostructure results also in enhanced photocurrents generated in such electrodes. For SIF-containing samples we measured photocurrents exceeding 1000 nA $cm^{-2}$ (with overpotential of -300 mV), while for analogous reference sample photocurrents lower than 300 nA $cm^{-2}$ were observed.

Research was supported by project DZP/POLTUR-1/50/2016 funded by the National Centre for Research and Development.

REFERNCES

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