

Quantum Dots Improve Photovoltaic Properties of Purple Membranes under Near-Infrared Excitation*

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Purple membrane (PMs), in which the photosensitive protein bacteriorhodopsin (bR) naturally occurs, have photovoltaic properties and are promising for optoelectronic applications. However, PMs cannot effectively absorb light in the NIR spectral region. Semiconductor quantum dots (QDs), which have high two-photon absorption cross-sections in the NIR region, can significantly improve the light sensitivity of PMs by means of Förster resonance energy transfer (FRET) from QDs to bR inside PMs. The purpose of this study was to improve the photovoltaic properties of PMs by means of FRET from QDs to bR under NIR two-photon excitation. We made the QD–PM complexes and showed high FRET efficiency in them. Finally, we found that the current signal from the QD–PM material was higher than that in the case of PMs alone under NIR excitation. The obtained results clearly demonstrate improvement of the photovoltaic properties of PMs under NIR two-photon excitation due to the FRET from QDs to bR and show the prospect of designing new photosensitive bio-nano hybrid devices.

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