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Perovskite and plasmonic nanostructures as key elements in advanced optoelectronics

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Plasmonics have been recognized as promising platform that may premise the enhanced performance of next-generation optoelectronic devices. Plasmonic effects have been proposed as a solution to overcome the limited light absorption of thin film photovoltaic devices and diverse types of plasmonic solar cells have been developed. Recently, we made a comprehensive overview of the state-of-the-art progress on the design and fabrication of plasmonic solar cells as well as the understanding of the enhancement mechanism. In this presentation, we propose a few strategies to develop viable plasmonic DSSCs and OPVs based on metal-graphene oxide core-shell nanostructures or lithographically-induced plasmonic nanopatterns. Very recently metal halide perovskites have been attractive as solar energy harvesters due to efficient ambipolar transport and strong light absorption. They have rapidly advanced thin film photovoltaic performance; as a result, the observed instabilities urgently require a solution. We report the reduced-dimensionality (quasi-2D) perovskite films that exhibit improved stability in solar cell performance while retaining the high performance of conventional three-dimensional perovskites. The quasi-2D perovskites were also employed to develop limiting emitting diodes with the most bright and highest EQE. We provide an overview of the recent progress of perovskite-based photodetectors focusing on versatile compositions, structures, and morphologies of constituent materials, and diverse device architectures toward the superior performance metrics.

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