CHARGE-TRANSFER BETWEEN PLASMONIC NANOPARTICLES AND SINGLE LAYER MoS_2

Zoheb Khan[a], Raul D. Rodriguez[a,b], Andreas Horrer[c], Philipp Nagler[d], Gerd Plechinger[d], Mahfujur Rahaman[a], Manuel Martina[e], Claus J. Burkhardt[e], Christian Schüller[d], Tobias Korn[d], Monika Fleischer[c], Dietrich R.T. Zahn[a,b]

[a]Semiconductor Physics, Technische Universität Chemnitz, 09107 Chemnitz, Germany
[b]Center for Advancing Electronics Dresden (cfaed), Technische Universität Chemnitz, 09107 Chemnitz, Germany,
[c]Institute for Applied Physics, Eberhard Karls Universität Tübingen, 72076 Tübingen, Germany,
[d]Institut für Experimentelle und Angewandte Physik, Universität Regensburg, 93040 Regensburg Germany,
[e]NMI Natural and Medical Sciences Institute at the University of Tübingen, 72770 Reutlingen, Germany

Recently, intensive efforts have been made to control the electronic properties of MoS_2 monolayers by doping, including chemical doping[1], gate-bias tuning[2], and physical adsorption[3]. Plasmon-induced hot electrons generated by photo-excitation of Au nanoparticles can also lead to n-type doping of TMDC monolayers[4]. In this contribution, we report on the localized surface plasmons excitation in Au nanoparticles beneath single layer MoS_2. The subsequent changes in vibrational and optical properties of the MoS_2 monolayer were investigated via Raman spectroscopy and photoluminescence in order to evidence the effects of charge-transfer. We report for the first time the visualization as well as the intensity enhancement of the trion peak for this 2D/plasmonic system. Our findings can be effectively driven towards realizing the size and structure of the individual components of opto-electronic devices such as plasmonic field effect transistors.

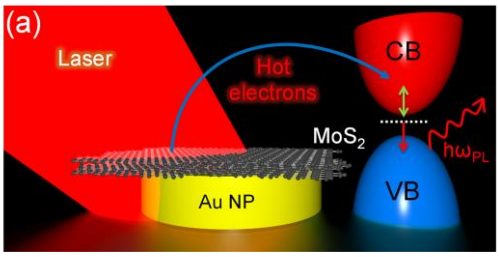

Fig. 1(a): Schematics of the interaction between the Au nanoparticle and MoS_2.

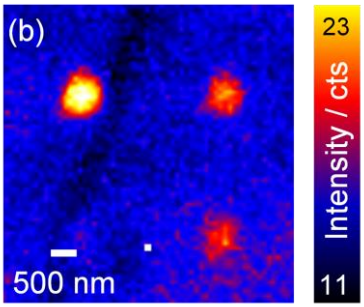

Fig. 1(b): PL intensity map of the 665 nm to 675 nm band showing higher enhancement in the MoS_2 single layer around the Au nanoparticles.

Keywords: MoS_2, plasmonics, hot electrons, two-dimensional, transition metal dichalcogenides, photoluminescence spectroscopy

References

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