Nanoplasmonics and surface enhanced spectroscopy

Directional resonance fluorescence from the ZnO:Al films

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Fluorophore situating near the metal-dielectric interface can be effectively coupled with plasmons in the metal giving interesting solutions for the nanosized waveguides, nanolasers and fluorescent sensors [1]. In the present report we applying the layered metal-semiconductor structures for the control of fluorescence from the aluminium doped zinc oxide, which could be prospective for defect-based single photon emitters [2]. Particularly film of ZnO:Al is deposited on the 50 nm gold layer, which was attached to the semicylindrical prism. Sample was irradiated by UV light at the wavelength 355 nm from the Nd:YAG laser. Angles φ of detection were scanned in the range from 25 to 75° on the side of prism. It was revealed that the intensity of defect-related fluorescence from ZnO:Al film can be significantly enhanced at resonance angles, which are near 42° for the p-polarized light and near 55° for the s-polarized light (see Fig. 1 as an example). We suggest that p-polarized fluorescence at 42° is effectively coupled with plasmons and s-polarized fluorescence at 55° is connected with leaky modes outgoing from the film working in the guiding regime.

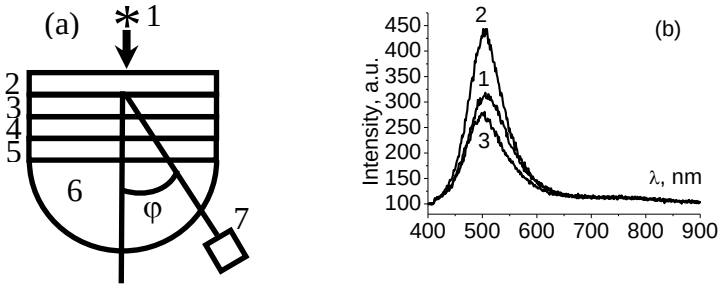

Fig. 1. (a) Scheme of the experiment (not in scale): 1- light source, 2 – ZnO:Al film, 3 – 50 nm gold layer, 4 –glass, 5 – immersion oil, 6-semicylindrical prism, 7 – detector; (b) fluorescent spectra detected for p-polarized light at different angles: 1) 40°, 2) 42°, 3) 45°.

1. *Enoch S., Bonod N. (Eds.)* Plasmonics, Springer-2012.-321 p.
2. *Jungwirth N. et.al.* A single-molecule approach to ZnO defect studies: single photons and single defects // J. Appl. Phys. – 2014.- 116, 043509.