Registration form

Name, Surname	Koshanova Aizhan Balgabaevna
University	Farabi Kazakh National University
Position	Ph Student
Course, Specialization	1 course, 8D07112 Nanomaterials and Nanotechnologies
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Authors	Koshanova A.B.
Supervisor	PhD, Associate Professor Mukhametkarimov Ye.S.
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SERS SUBSTRATES BASED ON AG NPS/WO_3 NANOCOMPOSITE THIN FILMS

Koshanova A.B.
Supervisor: PhD, Associate Professor Mukhametkarimov Ye.S.
Farabi Kazakh National University, Almaty, Kazakhstan
e-mail: aizhankoshanova.kz@gmail.com

The physical and chemical properties of tungsten trioxide (WO_3), in particular its high refractive index, good corrosion resistance, excellent optical modulation, and durability make this material attractive for a wide range of applications including photocatalysis [1], gas sensors [2], solar cells [3], and photoelectrochemical [4] devices. In addition, the incorporation of Ag nanoparticles (NPs) in WO_3 increases the sensitivity and selectivity of gas detection and enables detection and identification of various organic molecules using effect of localized surface plasmon resonance (LSPR) [4].

In this work, Ag NPs/WO_3 coatings were synthesized by RF magnetron co-sputtering on SQ1 quartz substrates. After the deposition process, the coatings were subjected to thermal annealing at 500°C in air for 1 min. After the annealing process, the samples were checked on activity towards Surface-Enhanced Raman Spectroscopy (SERS). SERS measurement was performed using an aqueous solution of methylene blue (MB) with a concentration of 10^{-6} M.

The surface morphology of the synthesized Ag NPs/WO_3 films before and after annealing was studied by atomic force microscopy (AFM). AFM image of annealed Ag NPs/WO_3 film (Fig.1b) showed that the average diameter of Ag NPs is about 30-50 nm.

The SERS spectra (Fig.1a) of MB consist of several peaks at 450, 773, 1401 and 1628 cm^{-1}, which correspond to different vibration modes of MB molecule [5]. The most intense Raman signal was registered when using annealed Ag NPs/WO_3 substrate as compared to as-deposited film (before annealing).

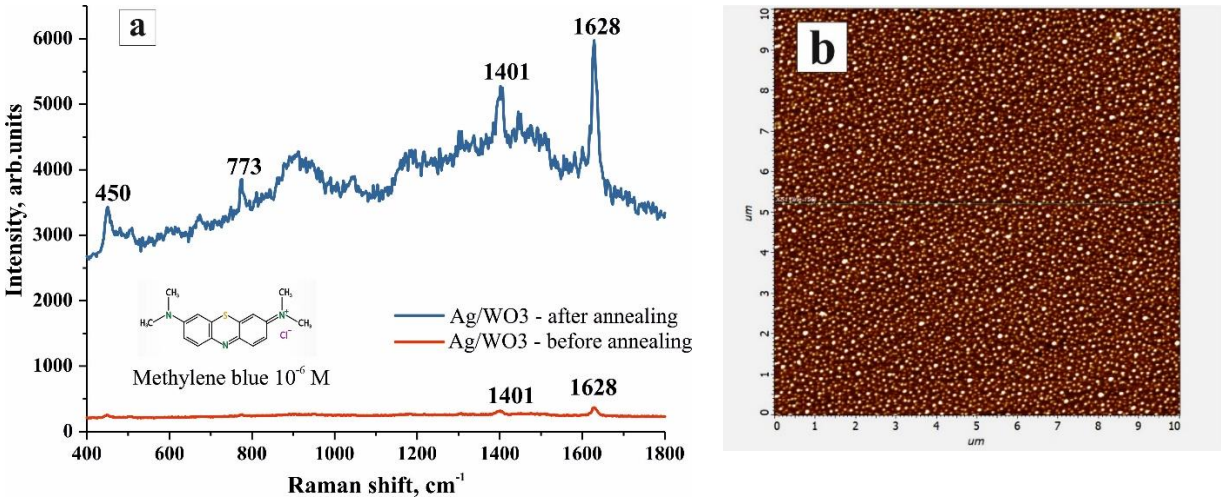

Fig. 1. – Raman spectrum of Methylene blue 10^{-6} M (a) and AFM image of Ag NPs/WO_3 after annealing (b)

References

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