



Buketov Karaganda University  
Institute of Molecular Nanophotonics

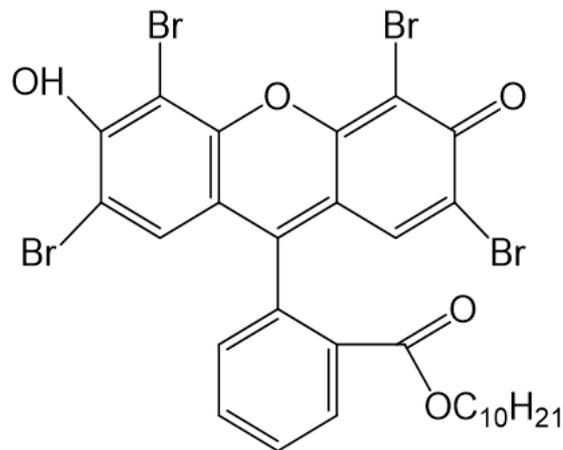
# INFLUENCE OF THE PLASMON EFFECT OF SILVER NANOPARTICLES ON THE PHOTONICS OF LANGMUIR–BLODGETT FILMS OF EOSIN

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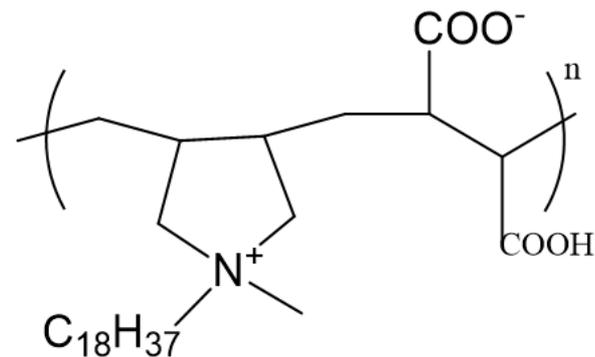
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**The aim of this work** is studying of the plasmon effect of silver nanoparticles on the deactivation of excited singlet and triplet states of Eosin molecules in thin films.

*Chemical structure of dye and polymer*



*Eosin*

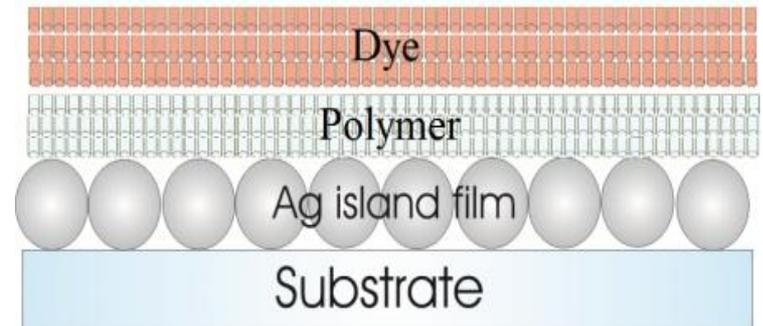


*Amphiphilic  
polymer*

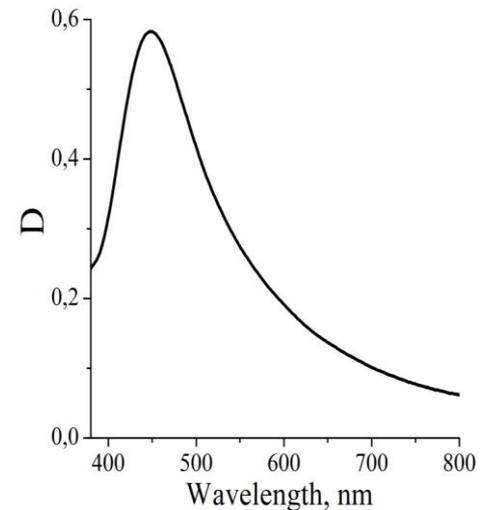
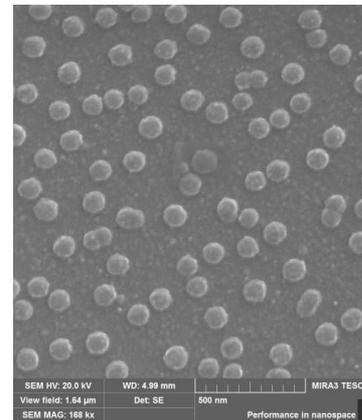
# Experiment

Nanosized films based on amphiphilic Eosin molecules and amphiphilic polymer poly(N,N-diallyl-N-octadecylamine-alt-maleic acid) were obtained using the Langmuir-Blodgett (LB) technology (KSV-NIMA trough). The distance between the lowest edge of dye LB film and silver surface was carried out using three monolayers of polyampholytic polymer (6 nm).

The absorption and luminescence spectra were measured on the Cary-300 and Eclipse spectrometers (Agilent), respectively. Fluorescence lifetimes of dyes were registered with time-correlated single photon-counting (TCSPC) system (Becker&Hickl GmbH) at  $\lambda_{\text{ex}} = 532$  nm.



*Scheme of the dye LB film deposited onto silver film*

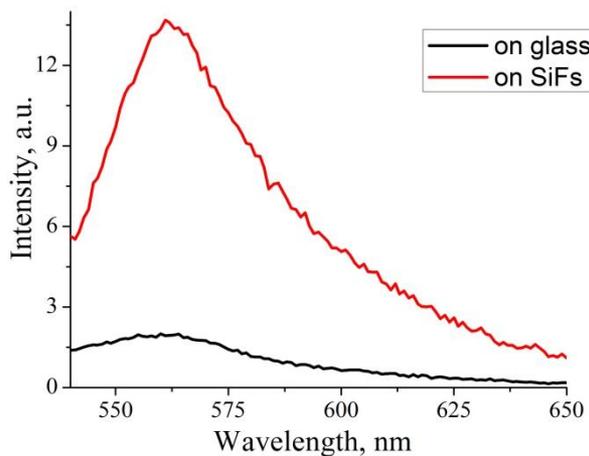


*SEM image and absorption spectra of silver island film (SiFs) obtained by the magnetron method*

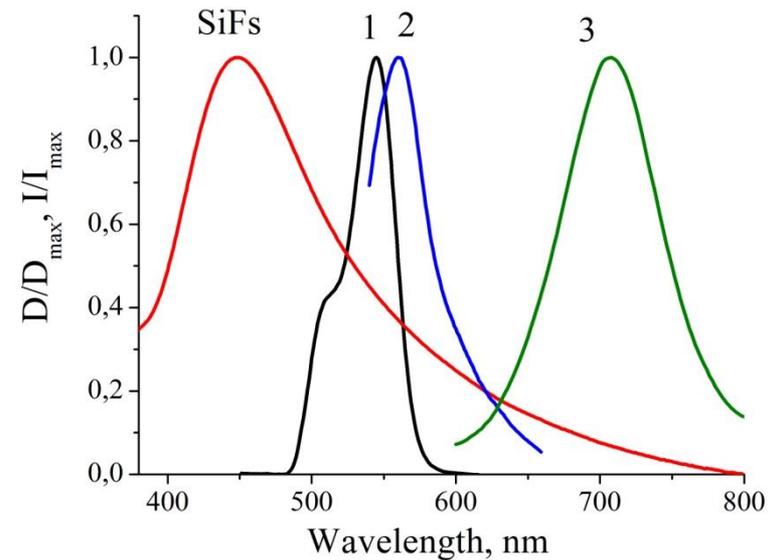
# Results

The influence of the plasmon effect on the absorption and luminescent properties of LB films of a dye on glass and SiFs with a polymer has been investigated.

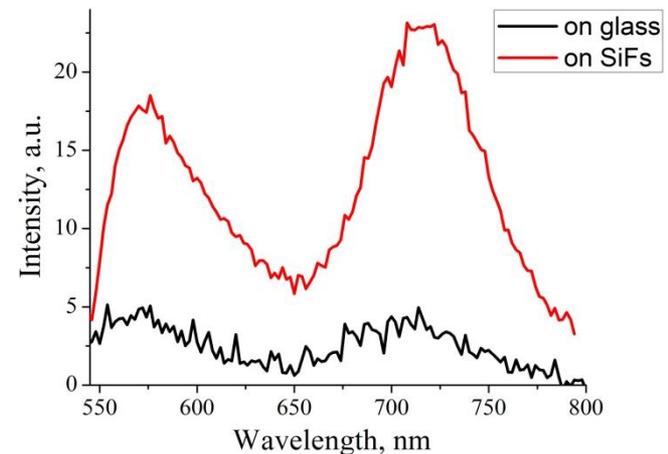
An 10% increase in optical density was observed on SiFs. The fluorescence intensity of Eosin on the SiFs was increased by 6.4 times, the intensity of delayed fluorescence and phosphorescence was increased by 3.8 and 4.7 times, respectively, compared to the control sample that did not contain silver nanoparticles (NPs).



*Fluorescence spectra of Eosin*

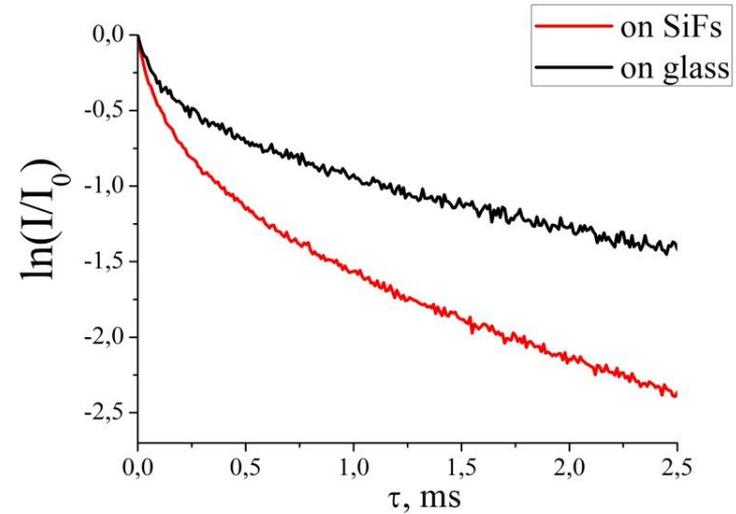
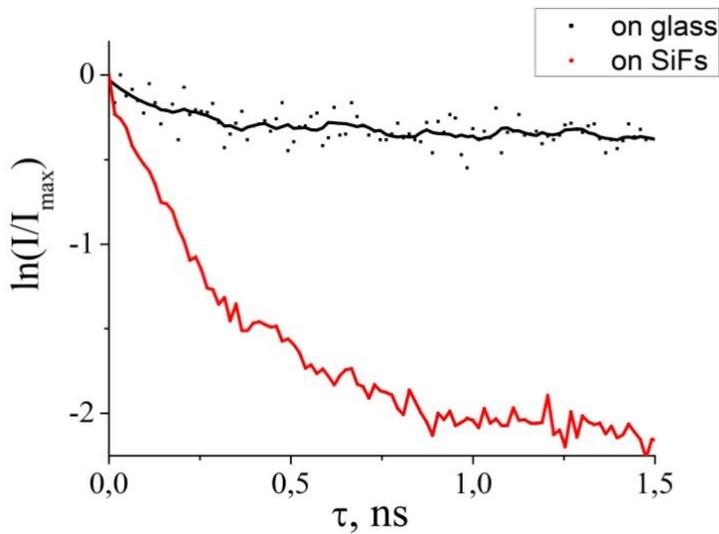


*Normalized absorption spectra of SiFs, absorption spectra (1), fluorescence (2) and phosphorescence (3) of Eosin*



*Phosphorescence and delayed fluorescence spectra of Eosin*

*Fluorescence (left) and phosphorescence (right) decay kinetics of Eosin on glass and SiFs*



*Spectral and kinetic data of fluorescence, delayed fluorescence and phosphorescence of dye*

Samples	Fluorescence		Delayed fluorescence		Phosphorescence	
	enhancement factor	$\tau_{fl}$ , ns	enhancement factor	$\tau_{DL}$ , ms	enhancement factor	$\tau_{Phos}$ , ms
Eosin on glass		0.57		2.4		2.5
Eosin on SiFs	6.4	0.24	3.8	2.2	4.7	1.5

\*The enhancement factor was calculated as the “peak” emission intensity ratio SiFs/glass.

# Conclusions

In the near field of silver NPs, an increase in the intensity of the fluorescence and delayed luminescence of the Eosin molecule is observed.

In this case, a decrease of fluorescence lifetimes and delayed luminescence lifetimes is observed.

The data obtained indicate an increase in the rate of decay of the  $S_1$ - and  $T_1$ -states of the Eosin molecules on Silver island films.

**Thank you for your attention!**