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Evaluation of amine functionalities bound on the ZnO surface by plasma processing used for biomolecule detection

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The primary goal of developing new bioimaging applications is to be able to make use of the nanomaterials and to get real time information about processes in the targeted organism. Materials with specific functions are intensively studied and they are very important due to the need to be implemented in dedicated applications for the detection of different biological processes. To be able to interact at this level not only the size of the material is important but also some requirements need to be satisfied. It is generally known that by downscaling the size of a material to nanometer scale is not always enough and thus preparation of them is needed. Our research focus is directed toward zinc oxide nanomaterials which already been proven to be suitable alternative among semiconductor based materials for implementation in diverse applications. We previously showed that by employing surface wave plasma excited in mixtures of ammonia and argon it is possible to bind amine groups on the surface of the zinc oxide nanomaterials both in the case of commercially available powder and also on nanoparticles obtained by laser ablation technique [1]. Exciting plasma in a mixture of 70% argon and 30% ammonia proved to be more suitable for the outcome of the functionalization as shown in the our previous work [1].

Our current study evaluates the number of amine groups that can be connected on the surface of the plasma processed zinc oxide nanomaterials by spectrophotometric study using SPDP protocol [2]. The SPDP crosslinker connects with the amine groups on the surface of the functionalized nanoparticles and later is cleaved by a reducing agent (represented by DTT). Measured intensity of the absorbance at 343 nm is directly correlated with the number of amine groups bound at the surface of the ZnO nanoparticles.

Figure 1 shows the calculated number of amino groups by correlating the absorbance measurements and it is clearly revealed that by using a mixture of gases to excite the surface wave plasma the number of amine groups on the surface of the zinc oxide commercial powder is increased compared with only the case when pure ammonia is used. These results are in good correlation with our previous reports and show good premises for the use of zinc oxide functionalized material for detection of specific biomolecules. Selective connection of our nanoparticles with dextran sugar chains is possible and further details about this will be presented at the conference.

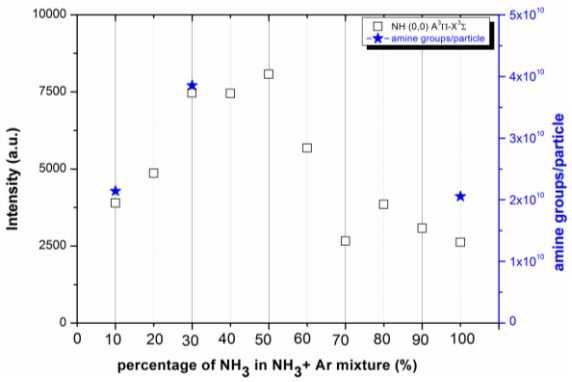

Figure 1. Amine groups bounded on the surface of functionalized ZnO compared with NH 336.1nm line from optical emission spectra

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References:
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[2] http://www.piercenet.com/instructions/2160279.pdf