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プラズマ表面修飾した ZnO ナノ微粒子の特性評価

Characterization of plasma functionalized ZnO nanoparticles

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Bio-imaging applications require the use of biomaterials which exhibit properties that can be tuned in such a manner as to specifically target a process in a fast and reliable way. For detection of different biological processes nanoparticles (NPs) can be used due to their large surface to volume ratio.

We propose the use of zinc oxide (ZnO) NPs taking advantage of their dielectric and luminescence properties, and prepare them for such bio-imaging applications. We have already proven the successful functionalization of ZnO NPs by plasma processing. First, using our millisecond Nd:YAG pulsed laser system we are producing the ZnO NPs with controllable size in the range of 10-100 nm. Using surface wave plasma (SWP) as a dry chemical reactor we are able to modify the surface of our ZnO NPs obtained by pulsed laser deposition (PLD) by adding amino groups. The outcome of our functionalization is proven by using XPS, chemical derivatization and also fluorescence microscopy. Optical properties of the ZnO NPs can be tuned by changing the crystalline structure of the lattice as shown in our previous results. Photoluminescence measurements of the crystalline ZnO nanomaterials show a sharp peak centered at 390nm and by controlling the number of the defect in the structure of the NPs, represented by the oxygen vacancies, the green band emission can be manipulated.

In this research we study the influence of the time and gas mixture (argon and ammonia) used in the SWP for processing our ZnO NPs. Photoluminescence of our functionalized ZnO NPs exhibits an enhancement of the green band emission for the functionalized samples as can be seen in Fig. 1 as a function of plasma processing time. In the same time, a mixture of Ar and NH_3 of 9:1 seem to be better than pure ammonia for the enhancement of photoluminescent properties.

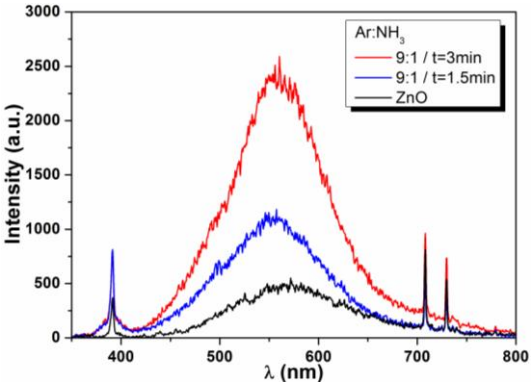

Figure 1. PL measurements of processed ZnO NPs

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