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Polymer films with dyes and quantum dots CdTe for ultralow concentration ammonia sensors

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Ammonia ultralow concentration in exhalation or skin vapors is an informative indicator of a certain cellular-molecular metabolic processes stability connected with the ammonia formation and output in the body, which occurs due to sequelae or diseases initial symptoms, are often inaccessible for the existing hardware facilities diagnosis. The purpose of this work is the creation of a new fluorophore film material with gas-sensory properties sensitive to ammonia ultralow concentrations in endogenic respirations and in the environment.

Dimensional hybrid complexes of polymer – sorbing agent – dyes of varying fluorophore activity - fluorescence activator basic structure were composed for investigation. Dyes molecules: Coumarin -7 with fluorescence emission at a wavelength of 493nm; 6G rhodamine dye with wavelength λ_{\max} =550nm, “Alpha Akonys” Russia production; Nile red dye with wavelength λ_{\max} =628nm, PAO “Shostka Plant of Chemical Reagents” production were used for fluorescent signal comparison in our research work. Quantum dots CdTe of the diameter up to 10nm, of the maximum luminescence band at wavelength of 530nm, 549nm, 608nm (“BukTehNano” production, Ukraine, Chernivtsi) were used as fluorescence activator. Samples have been formed on glass substrates in two ways:

1. Covering with layers of EVA (ethylene vinyl acetate) polymer, sorbing agent SiO₂, quantum dots CdTe dye chromophore complex solution;
2. Film derivatization from liquid solution of PVA (polyvinyl alcohol) polymer, dye in ethanol solution and quantum dots CdTe.

As a result, polymer structures (film and coating) with sensitive to ammonia fluorophore complexes were created. Fluorescence spectra of the samples and their fluorescent response to ammonia molecules were registered by Flx-800tM fluorometer. It was found that complex was formed due to dye in ethanol solution while adding quantum dots CdTe which caused the fluorescence intensification post radiationless energy transfer from nanocrystal to dye molecule. The fluorescence intensity decreasing of given fluorophore complex in the presence of ammonia molecules in trace amounts (5-10 ppm) was demonstrated.