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D. Tomeček, P. Fitl, E. Marešová, J. Vlček, J. Hofmann, M. Vršata

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SILVER PHTHALOCYANINE THIN FILMS CARRYING GOLD, PALLADIUM AND SILVER NANOPARTICLES FOR DETECTION OF TAGGANTS IN EXPLOSIVES

D. Tomeček^{a,□}, P. Fítl^a, E. Marešová^a, J. Vlček^a, J. Hofmann^a, M. Vrnáta^a

^aDepartment of Physics and Measurements, University of Chemistry and Technology, Prague, Technická 3, 166 28, Prague 6, Czech Republic

□Corresponding author: e-mail: *David.Tomecek@vscht.cz*

ABSTRACT

Our work deals with thin films of silver phthalocyanine (AgPc) combined with gold, palladium and silver nanoparticles. These films were applied for the indirect detection of 2-nitrotoluene which is used as a taggant in explosives. The films were deposited by an Organic Molecular Evaporation and a DC magnetron sputtering. The growth of metallic nanoparticles was continuously monitored through in-situ resistance measurements to detect the percolation threshold. We varied composition of the nanoparticles, their amount (the sputtered equivalent thickness was in the range from 1 to 50 nm) and also the geometry of sensing layers: geometry i) bottom AgPc + top nanoparticles, geometry ii) top AgPc layer + bottom nanoparticles.

The sensors with geometry i) exhibited good recovery capabilities, those with geometry ii) seemed to better preserve phthalocyanine sensing properties. For the best combination, the AgPc(50 nm)/Au(10 nm) sensor, its dc-response rose to the value of 373 for 190 ppm of 2-nitrotoluene. This suggests that 2-nitrotoluene can be detected in the sub-ppm concentrations by these films.

KEYWORDS: Phthalocyanine thin films; Metal nanoparticles; percolation threshold; taggant in explosives; magnetron sputtering.

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