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Atmospheric Pressure Dielectric Barrier Discharge - Deposition of Porphyrin Containing Colorimetric Gas-Sensing Surfaces

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The preparation of colorimetric gas sensing surfaces has been of growing interest during the last years. Among various types of sensors, (metallo-) porphyrin based devices are playing an important role and have been used for the detection of a wide range of analytes, including volatile amines.^[1] To overcome problems with aggregation of the sensor molecules and to increase the mechanical and thermal long-term stability of the sensor devices it is convenient to incorporate the porphyrins in an appropriate matrix. Besides other techniques, atmospheric pressure dielectric barrier discharge (AP-DBD) is a new arising technology capable to grow such smart composite films.^[2] Here we present the co-deposition of siloxane precursors along with a new class of zinc- and chromium-porphyrins suitable for volatile amine detection^[3] in a nitrogen fed AP-DBD. The resulting composite coatings are coloured, adherent and exhibit the characteristic IR spectrum of polydimethylsiloxane (PDMS). Scanning electron microscopy (SEM) shows smooth and almost particle-free surfaces, while secondary ion mass spectroscopy (SIMS) reveals the uniform distribution of the porphyrins in the polymeric membranes. UV-vis absorption spectroscopy of the deposited films shows the characteristic porphyrin spectra and the signal shape indicates that porphyrin aggregation is suppressed. High performance liquid chromatography coupled to mass spectrometry of dissolved layers proved the integrity of the sensor molecules in the deposition process. Finally, the foils were exposed to volatile amines in UV-vis experiments to show their capability as colorimetric gas-sensing devices.

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Keywords

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