

Carbon nanotube based NO₂ gas sensors

Introduction

CEA partner is in charge of developing a low cost and flexible NO₂ sensor. It's mainly relevant for air quality monitoring near roadways or in urban areas. NO₂ is toxic and irritating to the respiratory system which could lead to irreversible effects in 30 minutes exposure to 50 ppm of NO₂. The sensitive material is based on single walled carbon nanotubes (CNT) 2D random networks printed on paper.

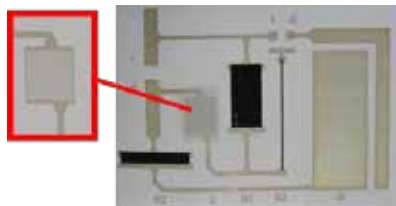
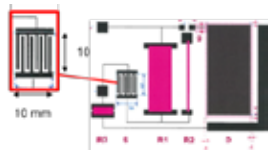
Objectives

To develop CNT inks aiming a direct printing of the NO₂ sensor active channel on paper

- room temperature
- low power consumption
- high sensitivity

Final prototype

Roll-to-roll gravure of silver paste for fingerprint structures @ LT

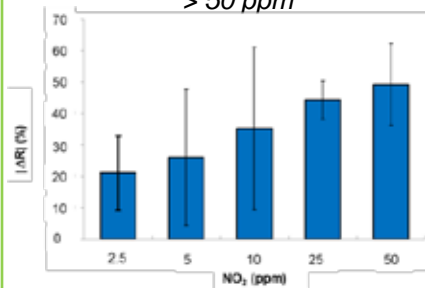


FS3 paper @ Felix Schoeller

Spray coating of CNT based sensitive material @ CEA

DEMO 2: a smart poster for air quality monitoring

3 levels of NO₂ sensing
 < 5 ppm
 5 to 50 ppm
 > 50 ppm

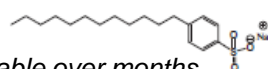


Results

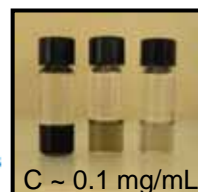
Water based carbon nanotube inks

SWCNTs having a nitric acid treatment (Carbon Solution)

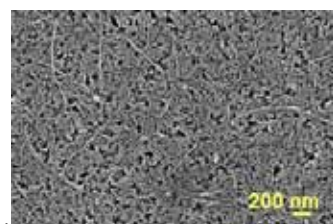
Stable over months



SDBS



Printing process by spray coating on paper

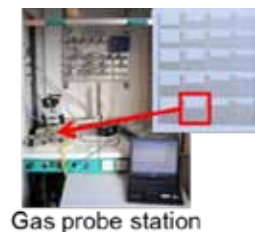
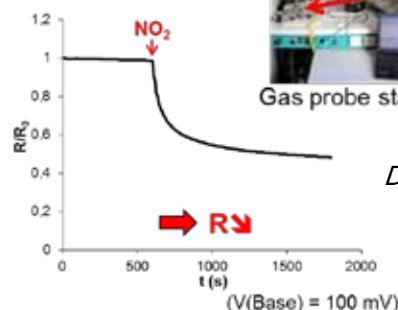


Low T process (80 °C)

~ 5 – 7 tubes/μm²

Sensing experiments under NO₂ exposure

Electrical response



Strong resistance variation under NO₂ exposure

Conclusion

In the framework of the A3Ple project, CEA has developed a NO₂ sensor based on printing of carbon nanotube networks on paper. Strong resistance variation under gas exposure has allowed to clearly measure three levels of detection.

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