European Network on New Sensing Technologies for Air Pollution Control and Environmental Sustainability - *EuNetAir*

COST Action TD1105

3rd International Workshop *EuNetAir* on

New Trends and Challenges for Air Quality Control

University of Latvia - Faculty of Geography and Earth Sciences

Riga, Latvia, 26 - 27 March 2015

ETHYLENE VINYLACETATE COPOLYMER AND NANOGRAPHITE PARTICLE COMPOSITE AS VOC SENSOR

Santa Stepina, G. Sakale, M. Knite

Participant / Santa.Stepina@rtu.lv

Institute of Technical Physics, Riga Technical University / Latvia

COST is supported by the EU Framework Programme

ESF provides the COST Office through a European Commission contract

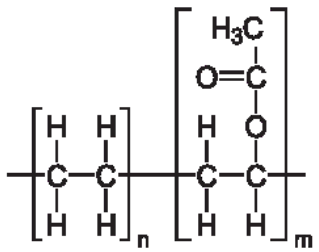
Introduction

- Toluene is used widely in the manufacture of polymers for plastic bottles and to make polyurethane and nylon, in the manufacture of cosmetics and in the manufacture of dyes and inks. Also toluene can be used as a fuel additive where it is used to increase the octane ratings and as a solvent in cleaning agents, adhesives, resins, paints and paint thinners.
- But OSHA (Occupational Safety & Health Administration) permissible exposure limit (PEL) for toluene in general industry is 200ppm that can **cause central nervous system depression, causing fatigue, headache, confusion, paresthesia, dizziness, and muscular incoordination.**
- But only 10 minutes in 500ppm of toluene vapours can cause **irritation of the eyes, mucous membranes, and target upper respiratory tract** [1].

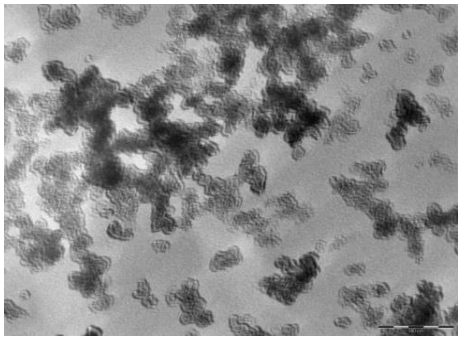
1. Federal Regulations (USA) Title 29: Labor, Part 1910—occupational safety and health standards (continued), Subpart Z—Toxic and Hazardous Substances, §1910.1000 Air contaminants.

Materials

Ethylene vinylacetate copolymer (content of vinylacetate (VA) is 40%; Sigma Aldrich)



Graphitezed nanoparticles (carbon black) PRINTEX XE-2 with average particle size 30nm. Particles specific surface: 950m^2/g and DBP (dibutyl phthalate) adsorption: 380ml/100g.



TEM A Philips TEM-301 Keen View II CCD camera. Scale 500nm.

Sample preperation

Carbon black (CB)

● + Chlorophorm

Ultrasound homogenizer

Ethylene vinyl acetate copolymer (EVA)

+

Chlorophorm

Dipcoating

EVA – CB

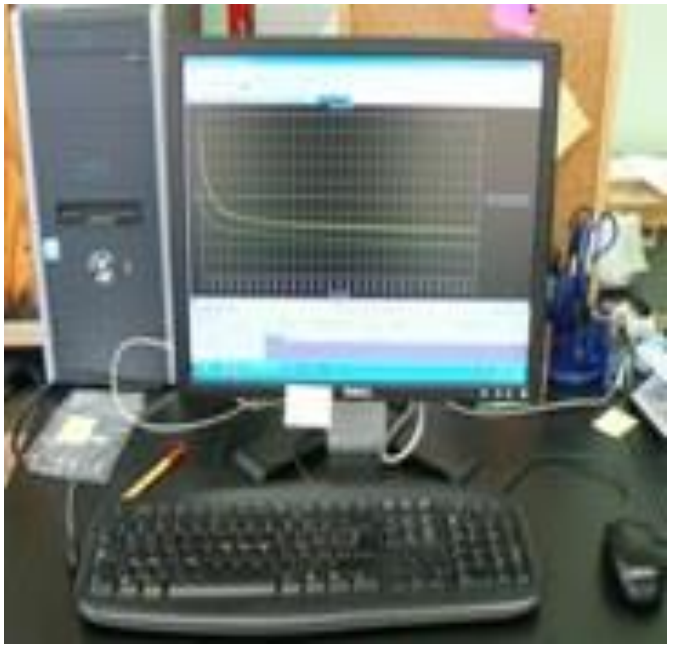
14mm

10mm

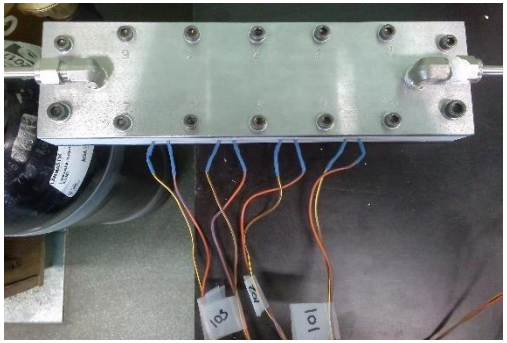
Methods

KIN-TEK Flex Stream

Agilent 34970A

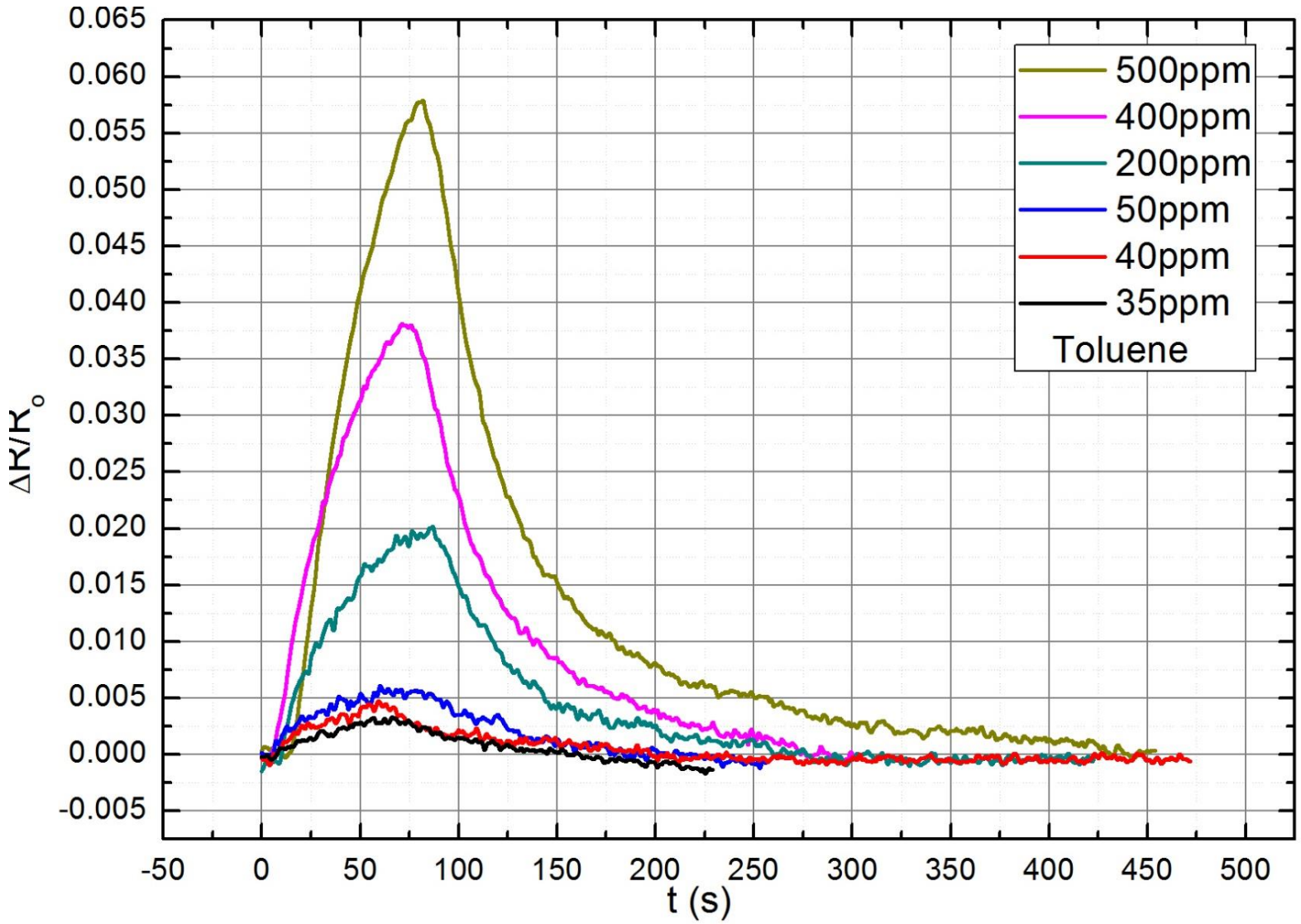


Computer for data logging



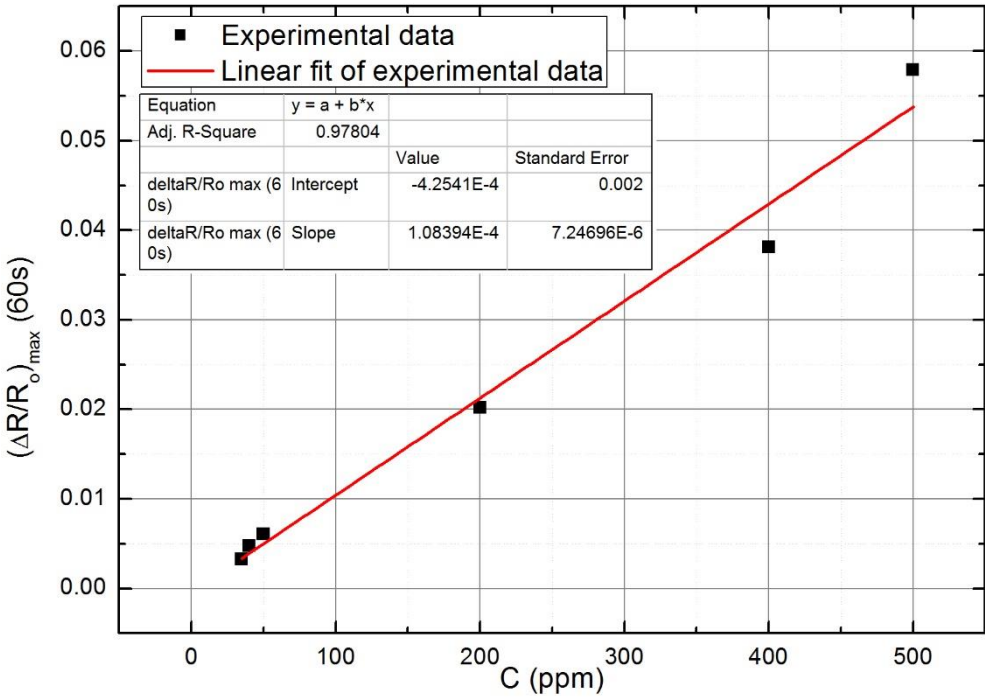
Sample container

Results

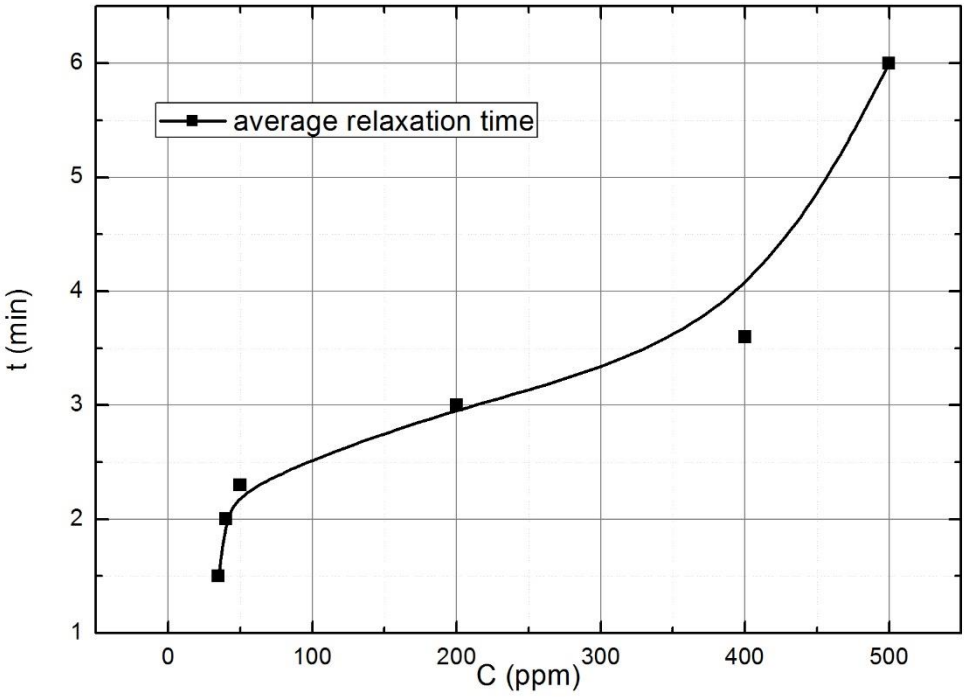


EVA-CB (7,75 mass parts) relative electrical resistance change versus time in toluene vapours (60 seconds) in various vapour concentration.

Results

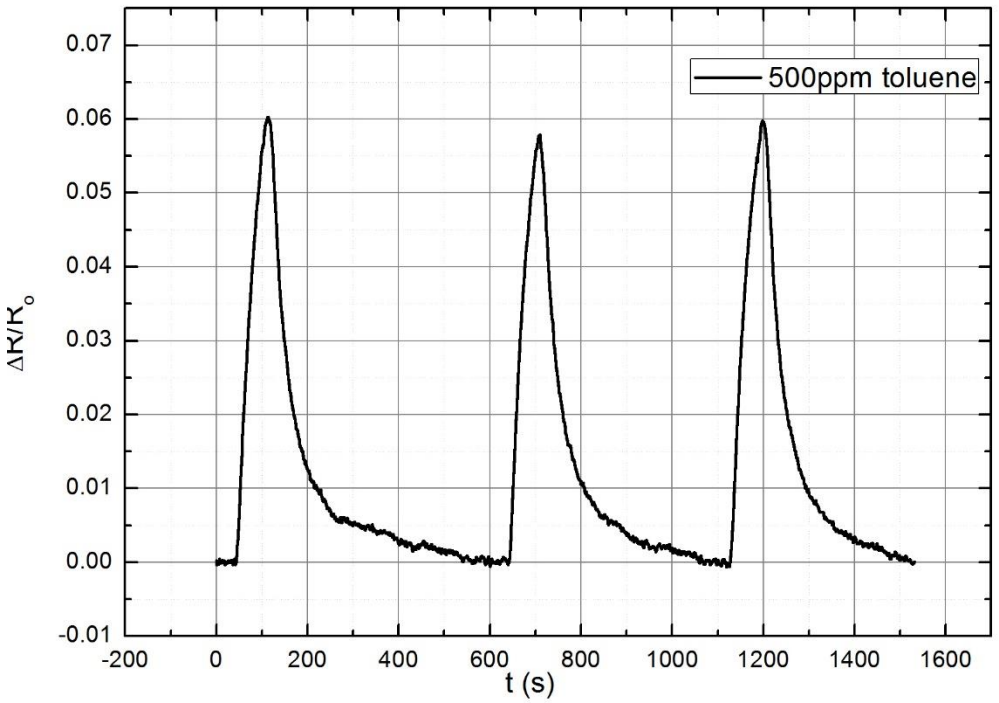


EVA-CB (7,75 mass parts) maximal relative electrical resistance value at 60 seconds versus toluene vapour concentration.

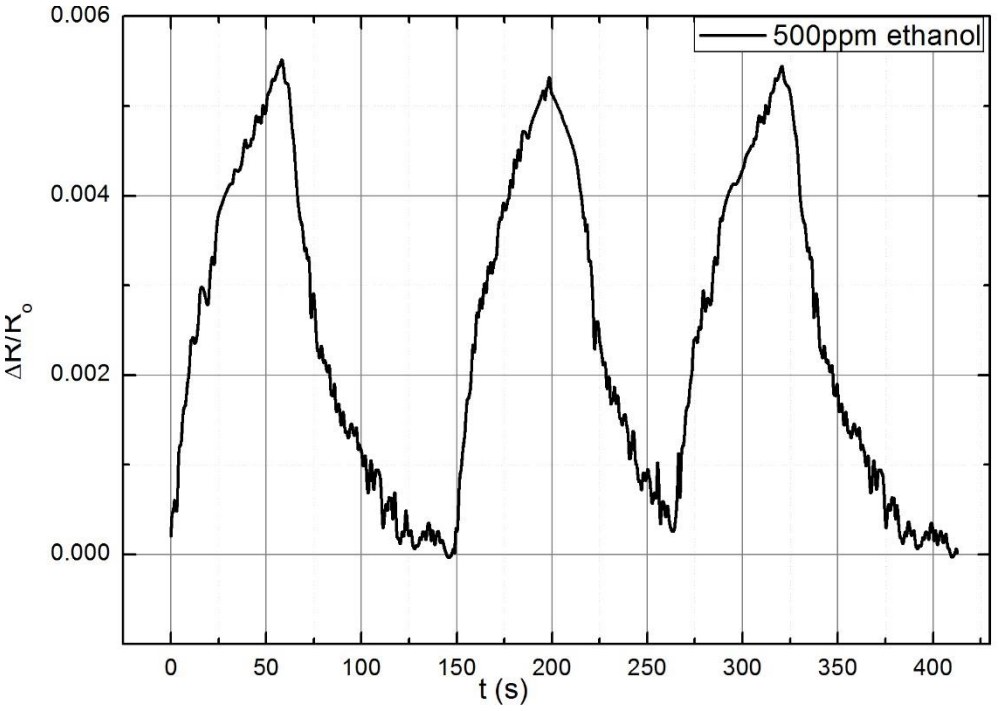


EVA-CB (7,75 mass parts) relaxation time versus toluene vapour concentration (60s).

Results



EVA-CB (7,75 mass parts) relative electrical resistance change versus time in toluene vapours (60 seconds).



EVA-CB (7,75 mass parts) relative electrical resistance change versus time in ethanol vapours (60 seconds).

CONCLUSIONS

- There are various health threts in case if inhaling VOC.
- EVA-CB composite are made and it's sensoreffect is determined.
- EVA-CB composite sensoreffect increases lineary with increasing toluene vapour concentration.
- EVA-CB composite shows significant difference between ethanol and toluene vapours. It can be explained with copolymer complex structure, where ethylene unit is non-polar and vinylacetate – polar.

Acknowledgement

This work was supported by ESF Grant Nr. 1DP/1.1.1.2.0/13/APIA/VIAA/030