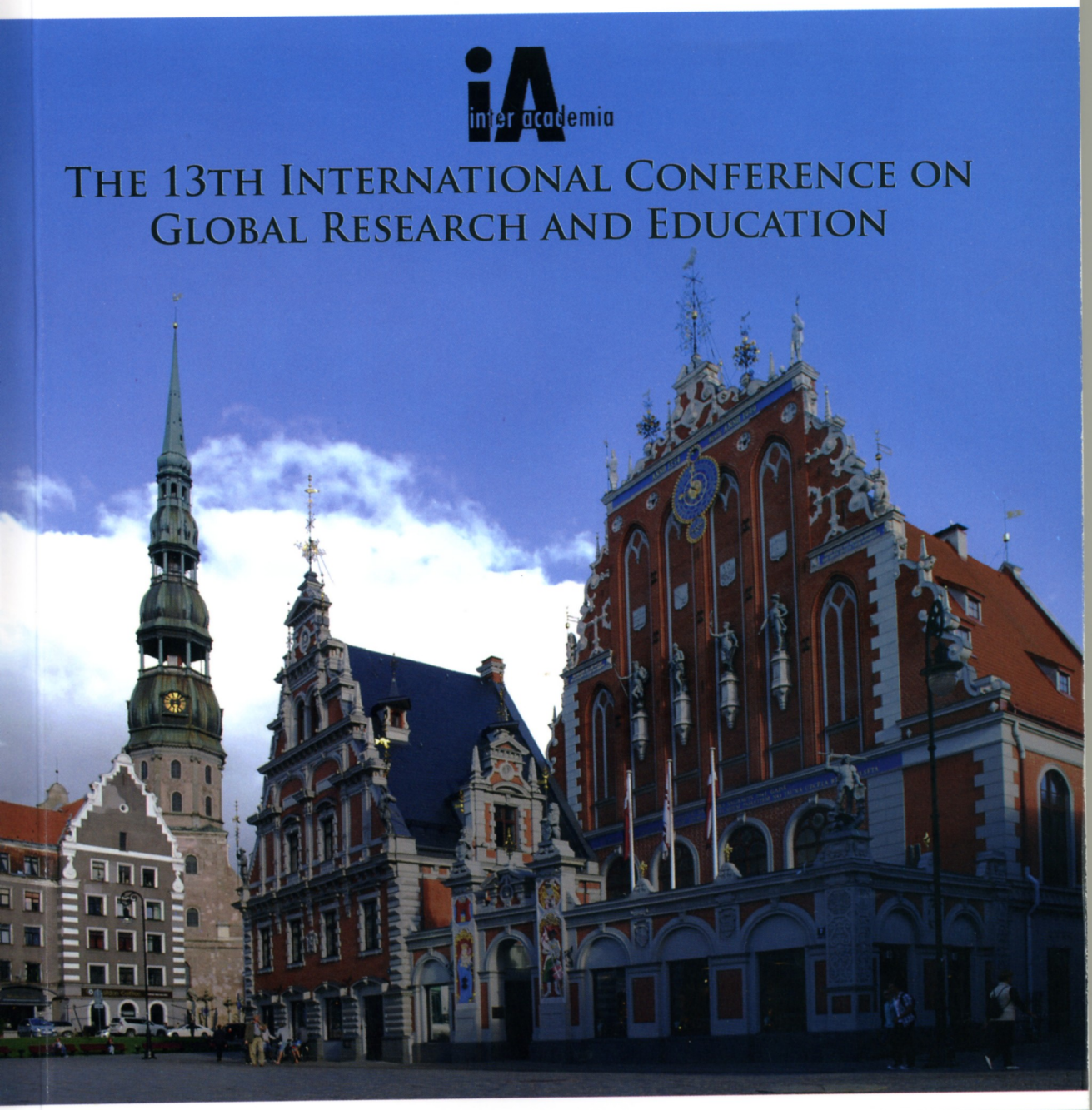
RIGA TECHNICAL UNIVERSITY

SEPTEMBER 10-12, 2014
RIGA, LATVIA



THE 13TH INTERNATIONAL CONFERENCE ON GLOBAL RESEARCH AND EDUCATION

INTER-ACADEMIA 2014

DIGEST

Ethylene vinyl acetate copolymer and nanographite hybrid composite as innovative material for chemical vapour sensing

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Summary
There is made three types of carbon composite: 1) Ethylene vinyl acetate copolymer (EVA) as matrix and carbon nanoparticles (CB) as conductive filler; 2) EVA matrix and carbon nanotubes (CNT) as filler; 3) EVA matrix and as filler are used two kind of conductive filler, CB and CNT. Sensor-effect is detected for all composite types.

Introduction
Big part of our live take transport, like car, bus or airplane. The usage of fuels is something that all these three means of transport have in common. Today we all talk of ecological fuels, cleaner transporting in order to save our planet, however there is still no ideal device invented that could detect if the fuel has been made accordingly to standards. That is why in the present work we developed a chemical vapour sensor, whose active layer is a thin film of a non-conductive polymer – ethylene vinylacetate copolymer – mixed with conductive nanographite particles, in order to develop new sensor device. With the term "nanographite" can be marked following fillers: extra-conductive highly structured carbon black (EHSCB), carbon nanotubes (CNT), thermally exfoliated graphite (TEG) as well as recently discovered graphenes because all of them have a sp^2-hybridized crystal structure like graphite, but at least one dimension of nanographite is smaller than 100 nm. In this research we used EHSCB and CNT separately as well as both combined as composite filler.

Materials and methods
To produce composite ethylene vinylacetate copolymer (Sigma Aldrich) is used as matrix. It is known that amount of vinylacetate impacts the copolymer crystallization degree and flexibility. In this case we used ethylene vinylacetate copolymer with 40 % vinylacetate content. Copolymer consists of ethylene and vinylacetate repeating units, where ethylene unit is non-polar and vinylacetate – polar. Copolymer complex structure indicates that the sensor could detect both polar and non-polar organic solvent vapours.
Nanographite particles (EHSCB: PRINTEX XE-2; CB) with average particle size 30 nm are used as conductive filler. Particles specific surface: 950 m^2/g and DBP (dibutyl phthalate) adsorption: 380 ml/100 g. PRINTEX XE-2 as mentioned before has high electrical and it has been used in many electrical rubber creation. Other composite was made with multi walled carbon nanotubes (SMWCNT; CNT) as conductive filler (CheapTubes; nanotubes

outside diameter is 50-80 nm but inside diameter 5-15 nm, length 0.5-2 μm and specific surface 40 m^2/g).
The third composite is made from two conductive fillers (CNT and CB) in order to create nanostructured hybrid composite.

Results and discussion

The sensing effect has been prooved for EVA-CB and EVA-CNT composites on various chemical vapours as well as various fuel vapours. In order to get higher sensor-effect (than EVA-CNT) and reduce coasts, EVA-CNT composite was modified with CB to create hybrid composite. On Fig. 1. both EVA-CNT composite and EVA-CB-CNT hybrid composite sensor-effect on toluene vapours are shown.

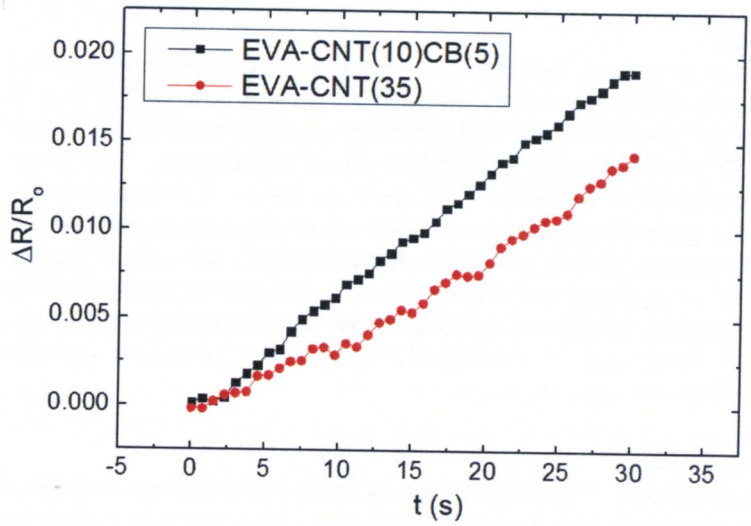

Fig. 1. Relative electrical resistance change versus time in toluene (2000ppm) vapours for 30 sec. Sample thickness 70μm.

Conclusion

There were made three types of composite samples for chemical vapour detection, where one of them is hybrid composites. Hybrid composite showed better sensitivity at certain fillers concentration.

Acknowledgement

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