THE INFLUENCE OF TECHNOLOGICAL PVD PROCESS PARAMETERS ON THE TOPOGRAPHY, CRYSTAL AND MOLECULAR STRUCTURE OF NANOCOMPOSITE FILMS CONTAINING PALLADIUM NANOGRAINS

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Nanocomposite carbon – palladium films (C-Pd films) are interesting because of their ability of hydrogen absorption and due to this feature of possibility of the application of these films as hydrogen and hydrogen contaaining compounds sensors. Technology of C-Pd films preparation was elaborated in ITR and the model of hydrogen sensor was prepared.

Nanocomposite C-Pd films were obtained by physical vapor deposition method (PVD method) using as precursors: C_{60} fullerenes and palladium acetate. Depending on technological parameters of PVD process such as current intensity through sources (I_{C60}, I_{Pd}), C-Pd films with various thickness, structure, morphology, topography and Pd content were obtained. Sources-substrate distance (d) was 60mm and deposition time (t) was 10min in all processes. Deposite of palladium acetate in carbonaceous matrix of prepared film changes the resistivity of film.

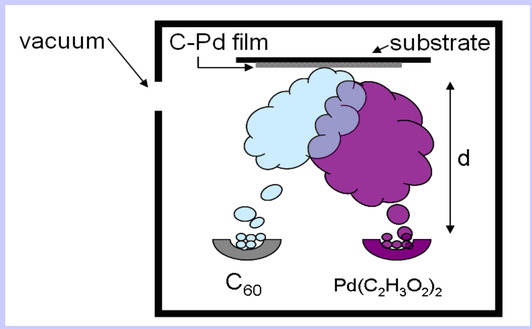


Table 1 Technological parameters of PVD processes

Sample	I_{C60}	I_{Pd}	T [°C]	R[kΩ]
S1	1.8	1.2	108	20
S2	1.9	1.2	80	4
S3	1.9	1.1	72	120000
S4	1.9	1.3	94	0.3
S5	2	1	75	$7.6 \cdot 10^9$
S6	2	1.1	94	187000

SEM results

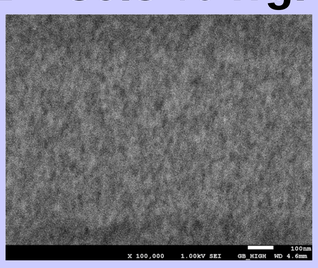
AFM results

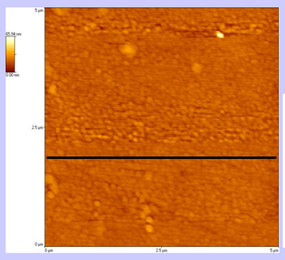
FTIR results

TEM results

I_{Pd} = 1.2

S1 30.5 % wg. Pd





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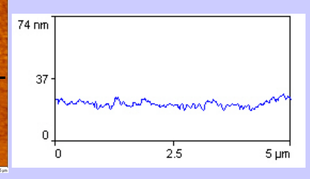
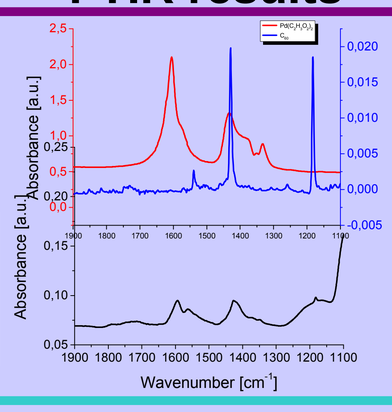
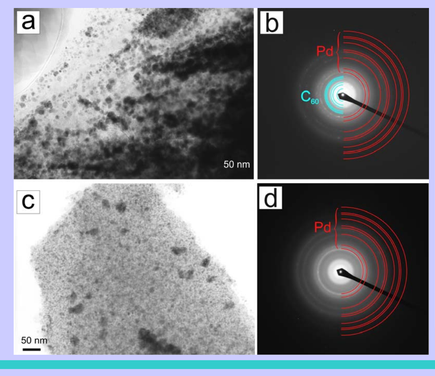
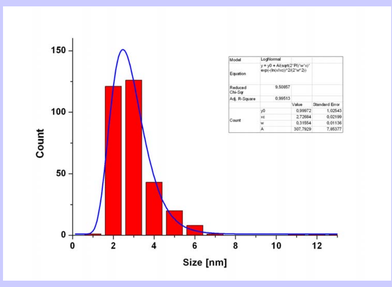


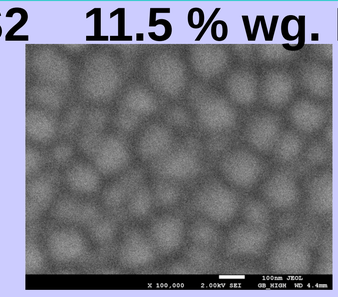


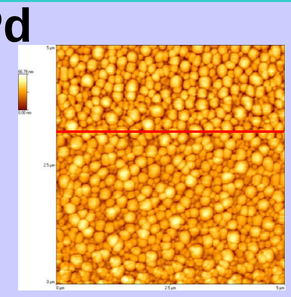




I_{C60} = 1.9

S2 11.5 % wg. Pd





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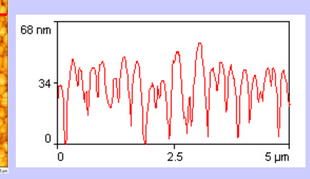
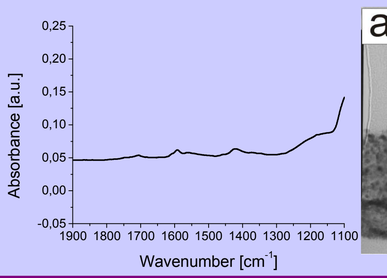
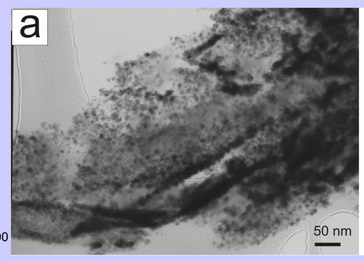
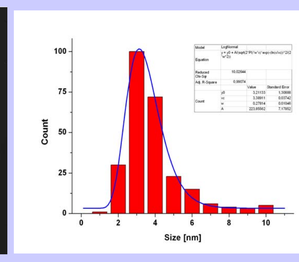
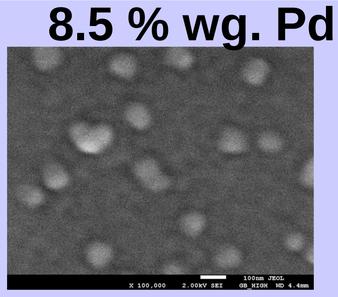


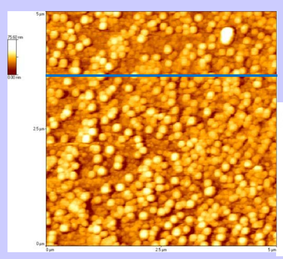






S3 8.5 % wg. Pd





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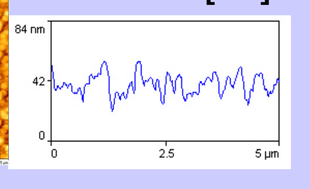
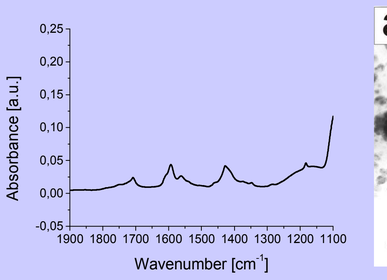
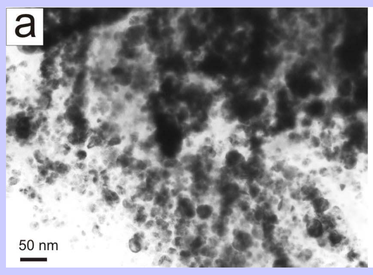
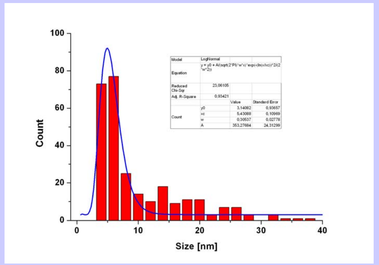
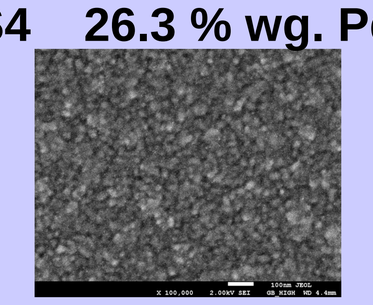


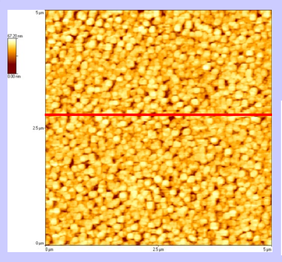






S4 26.3 % wg. Pd





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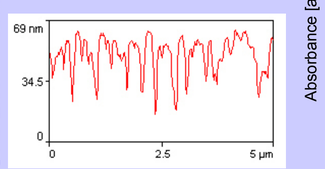
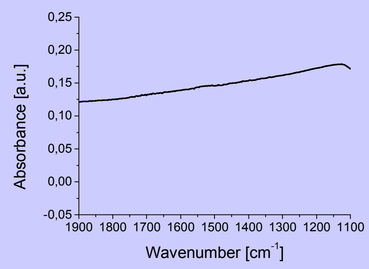
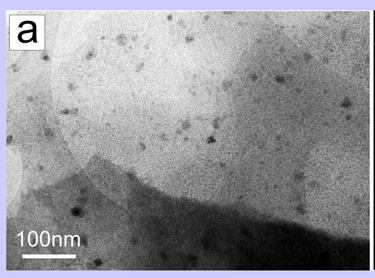
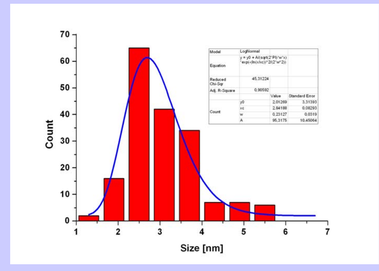


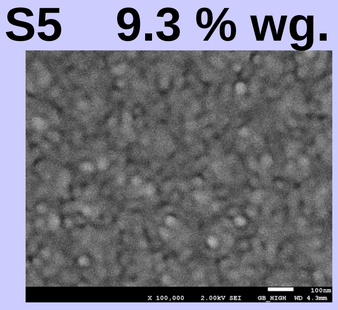


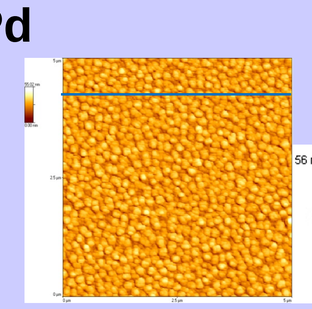




I_{C60} = 2

S5 9.3 % wg. Pd





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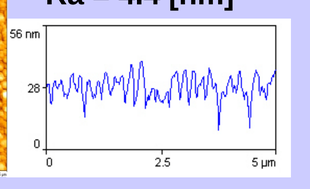
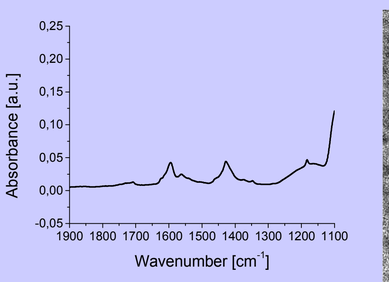
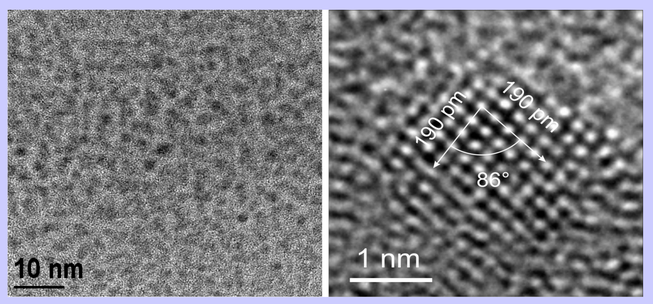
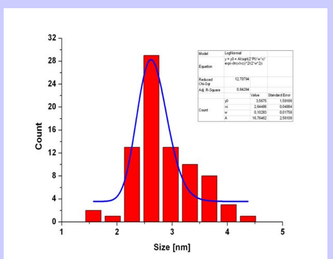
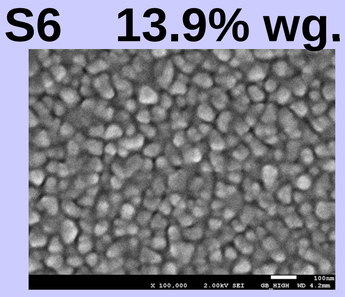


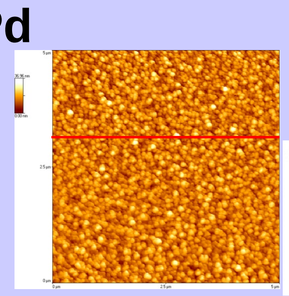






S6 13.9% wg. Pd





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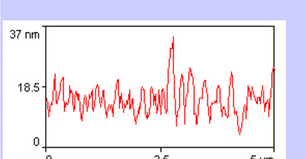

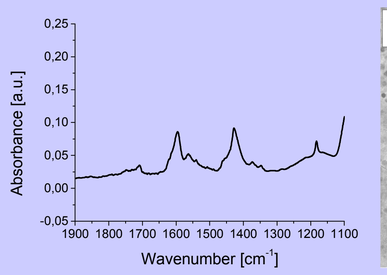

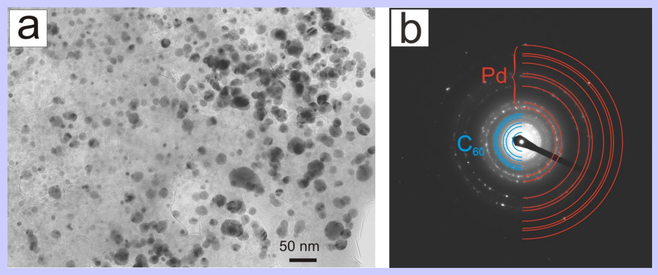

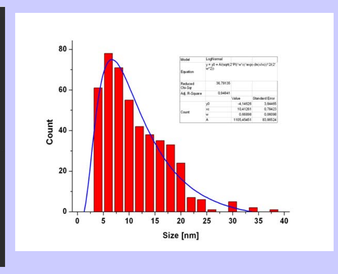

CONCLUSION

Parameters of technological PVD process have strong influence on the topography, structure and morphology of carbon films containing Pd nanograins (Pd-C films). We observed that films containing Pd *fcc* type of nanocrystals with different size embedded in a matrix composed of many forms of carbon (fullerite grains, amorphous carbon grains, loosely connected graphite planes). Manipulating with the process parameters we obtained films with different content of palladium. This affects on the resistivity, topography and the morphology of these films. The morphology of such film reflects a composition of the grain. The film is flat and smooth when it is composed of amorphous carbonaceous grains with very small Pd grains (S1). Films with many fullerite grains (S6 i S3) have granular surface.

ACKNOWLEGMENT

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