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Thin layers as a way of modification of working electrodes in voltammetry

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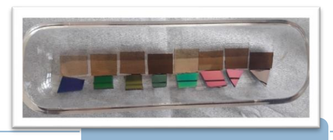
INTRODUCTION

Currently, research is focused on the search for new, physically and chemically stable materials as well as volume or surface modification. One of the methods used for surface modification is the application of thin layers from inorganic and organic compounds. The plasma enhanced chemical vapor deposition (PECVD) is a method that allows material modification and also deposition of thin layers. This work concerns optimization of cold plasma deposition parameters and to achieve the best electrical conductivity while maintaining the high mechanical strength of the formed layers.

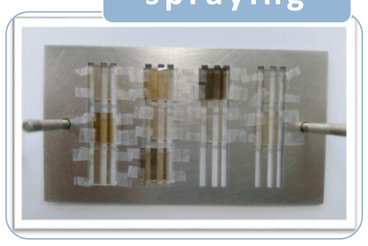
Choice of precursor
- Acrylonitrile AKN
- Dietoxydimethylsilane DMS
- Trietoxymethylsilane TriMS
- Tetramethylodisiloxane TMS

Deposition parameters
- discharge power
- time of treatment
- composition of gas mixutre

Calcination
- 500 °C 2h
- Argon atmophere



Aluminium spraying

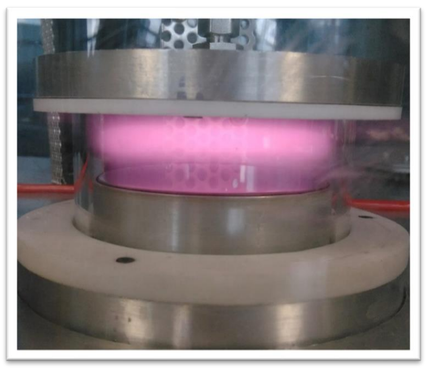


Thickness measurements
- Interference microscopy

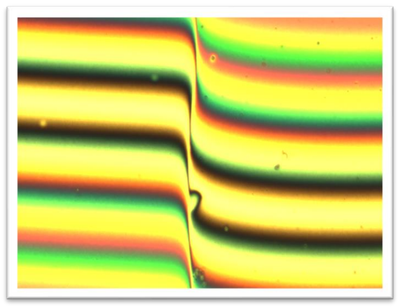
Conductivity measurements

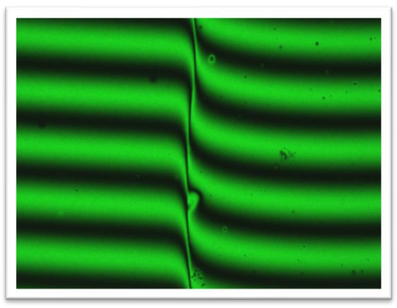
EXPERIMENTAL

Plasma enhanced chemical vapour deposition(PECVD)



Interference microscopy





$$D = \frac{d}{L} \cdot \frac{\lambda}{2} [nm]$$

D- layer thickness[nm],
λ= 546 [nm],
d- phase shift [mm],
L- the distance between the valleys of the zero line [mm].

RESULTS

ACRYLONITRYLE								
Discharge power [W]	10	10	20	20	40	40	80	80
Time of treatment [min]	2	4	2	4	2	4	2	4
Thickness [nm]	24.7	67	75.3	122.3	158.5	311.7	250	464.4
Conductivity[$S \cdot m^{-1}$]	151.2	45.4	31.1	18.5	0.002	15.6	19.1	0.003

DIETOXYDIMETHYLSILANE				
Discharge power [W]	20	20	40	40
Time of treatment [min]	2.5	5	2.5	5
Thickness [nm]	139.9	375.2	284.3	495.6
Conductivity[$S \cdot m^{-1}$]	16.4	5.5	10.5	4.0

TRIETOXYMETHYLSILANE			
Discharge power [W]	20	40	40
Time of treatment [min]	2.5	2.5	5
Thickness [nm]	146.9	242.8	353.1
Conductivity[$S \cdot m^{-1}$]	16.5	9.3	6.7

TETRAMETHYLDISILOXAN			
Discharge power [W]	20	40	40
Time of treatment [min]	2.5	2.5	5
Thickness [nm]	167.6	315.9	616.5
Conductivity[$S \cdot m^{-1}$]	21.3	9.5	3.1

REFERENCES

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2. J. Tyczkowski, R. Kapica, J.Łojewska, Thin Solid Films, 515 (2007) 6590.

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