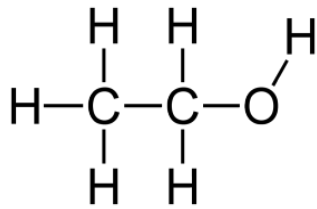


Effect of alcoholic solvent on electrophysical characteristics of PEDOT:PSS thin films

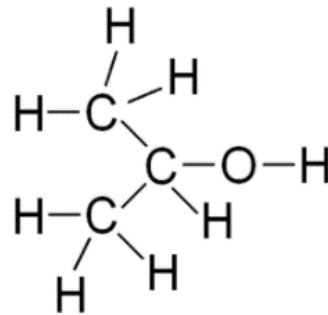
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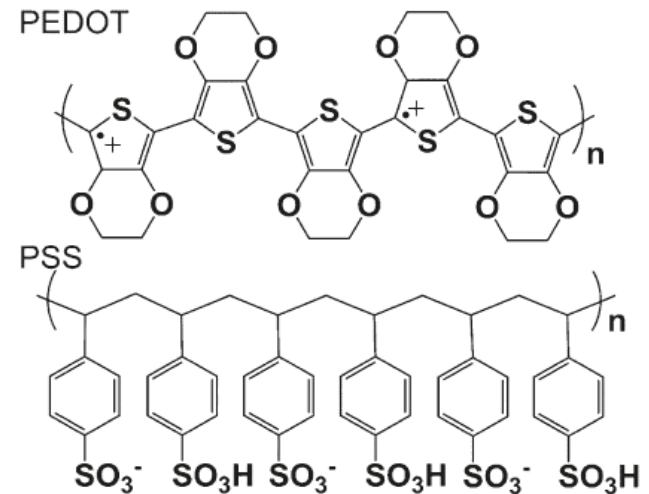
The objects of investigation are thin films of the conductive polymer PEDOT: PSS with a modified surface. The modification of the PEDOT: PSS polymer was carried out by adding ethyl and isopropyl alcohol to the bulk of the polymer and in alcohol vapors.



Ethanol



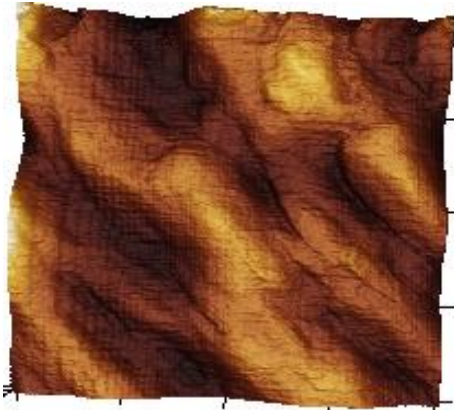
Izopropanol



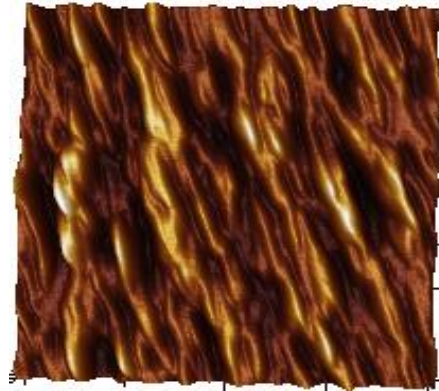
PEDOT and PSS

Chemical structure Ethanol, Izopropanol, PEDOT and PSS

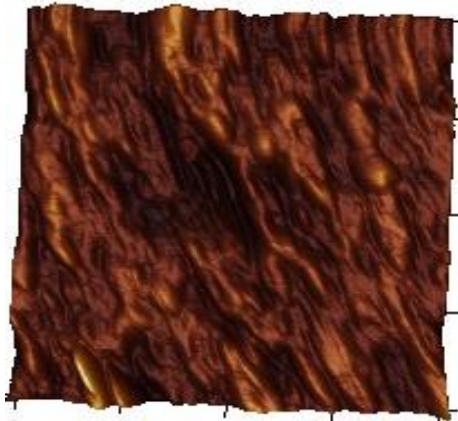
3D images of the surface morphology of PEDOT: PSS films



a



b



c



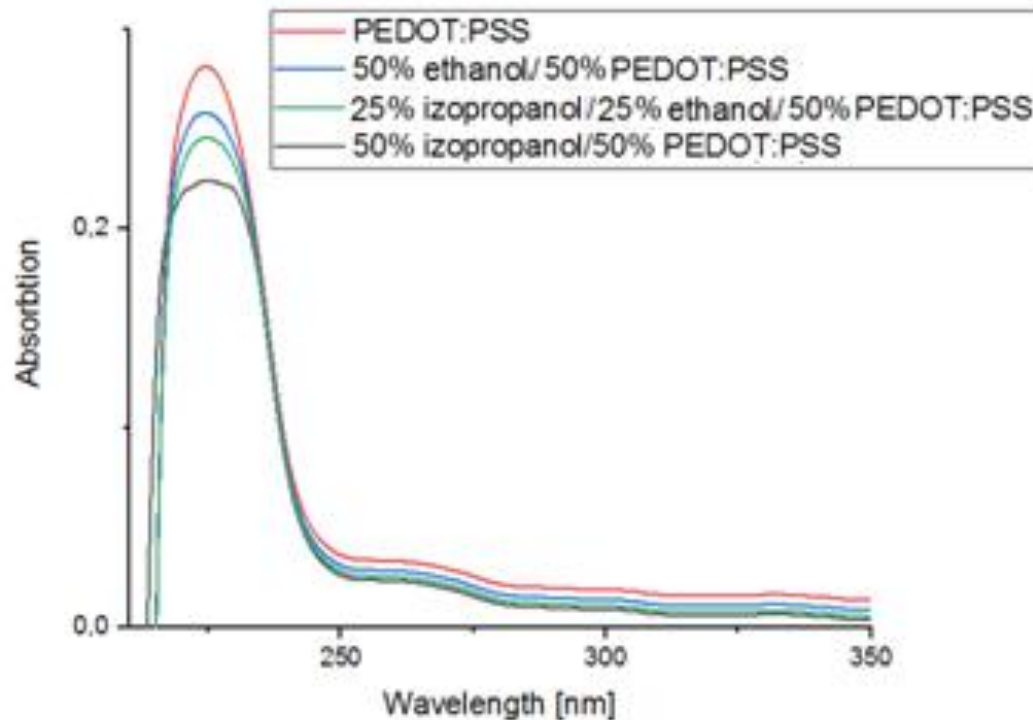
d

Sample	R_a , nm
PEDOT:PSS	1.03
50% PEDOT:PSS / 50% ethanol	0.88
50% PEDOT:PSS / 25% ethanol / 25% izopropanol	0.63
50% PEDOT:PSS / 50% izopropanol	0.56

- a) PEDOT:PSS; b) 50% PEDOT:PSS / 50% ethanol;
c) 50% PEDOT:PSS / 25% ethanol / 25% izopropanol;
d) 50% PEDOT:PSS / 50% izopropanol;

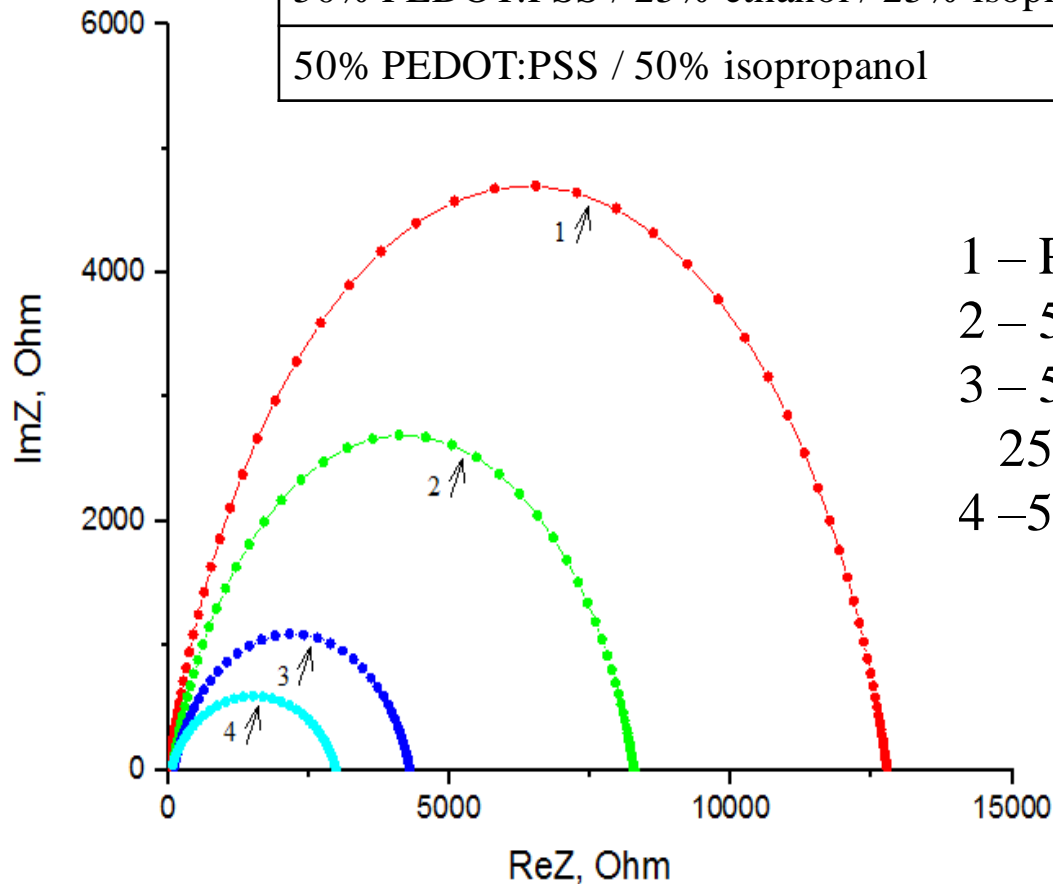
Absorption spectra

Sample	Adsorption Peak		D ₁	D ₂	FWHM, nm
	λ_1 , nm	λ_2 , nm			
PEDOT:PSS	224	260	0.28	0.03	28
50% PEDOT:PSS / 50% ethanol	224	260	0.26	0.03	29
50% PEDOT:PSS / 25% ethanol / 25% isopropanol	224	260	0.24	0.03	31
50% PEDOT:PSS / 50% isopropanol	224	260	0.22	0.02	32



Light impedance spectra of films of the standart and modified PEDOT:PSS

Sample	R_h, Ω	R_{ext}, Ω	k_{eff}, s^{-1}	τ_{eff}, ms
PEDOT:PSS	56.51	12772	47.86	20.89
50% PEDOT:PSS / 50% ethanol	50.45	7472.6	59.09	16.92
50% PEDOT:PSS / 25% ethanol / 25% isopropanol	41.45	4817.9	78.63	12.72
50% PEDOT:PSS / 50% isopropanol	28.11	2817.7	120.22	8.32



- 1 – PEDOT:PSS;
- 2 – 50% PEDOT:PSS / 50% ethanol;
- 3 – 50% PEDOT:PSS /
25% ethanol / 25% isopropanol;
- 4 – 50% PEDOT:PSS / 50% isopropanol

* voltage parameters -500 mV and frequency from 100 kHz to 0.5 Hz

Conclusion

- Modification of the PEDOT:PSS solution leads to an improvement in the morphology and structure of the film, namely to an improvement in the degree of domain homogeneity and a decrease in roughness
- Upon modification of PEDOT:PSS, a decrease in absorption due to the aromatic PSS fragment is observed in the optical spectra. This indicates a structural change in the PEDOT:PSS film upon the addition of alcohol solvents.
- The structural features of PEDOT:PSS affect the electrophysical parameters of the films. It was found that the modification of the structure of the conducting layer PEDOT:PSS leads to an improvement in the electrical transport properties of the film, which in turn increases the values of the efficiency and QE of the cell.

References

- [1] Yuan, X., Song, C., Wang, H., Zhang, J., 2010. EIS Equivalent Circuits. In Electrochemical Impedance Spectroscopy in PEM Fuel Cells (pp.139–192).
- [2] Aimukhanov A.K., Rozhkova X.S., Ilyassov B.R., Zeinidenov A.K., Nuraje N. The influence of structural and charge transport properties of PEDOT:PSS layers on the photovoltaic properties of polymer solar cells // Polymers Advanced Technologies. – 2020. – P. 1-8. <https://doi.org/10.1002/pat.5102>

This research is funded by the Science Committee of the Ministry of Education and Science of the Republic of Kazakhstan (Grant No. AP08856176).