Supporting information

Multiwalled carbon nanotubes - poly(3-octylthiophene-2,5-diyl) nanocomposite transducer for ion-selective electrodes. Raman spectroscopy insight into the transducer / membrane interface

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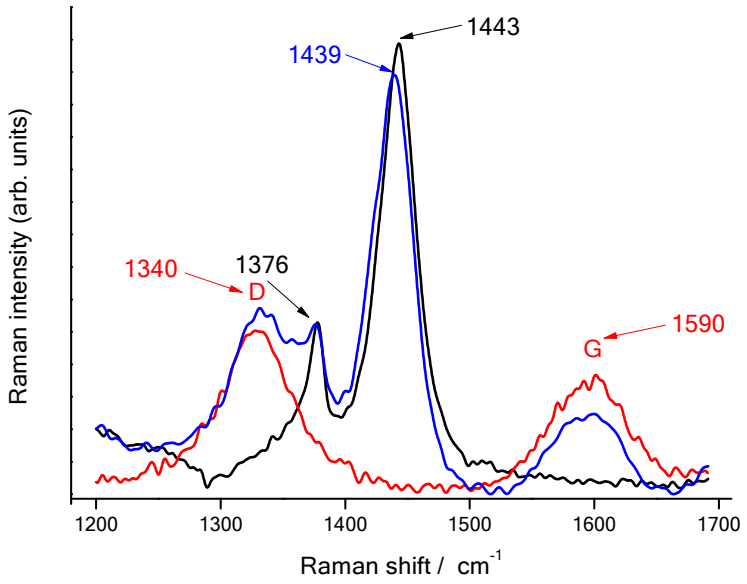


Figure S1. Raman spectra (λ_{exc}=632.8 nm) of MWCNT (red curve); POT (black curve) and MWCNT dispersed with POT – composite material (blue curve).

A) B)

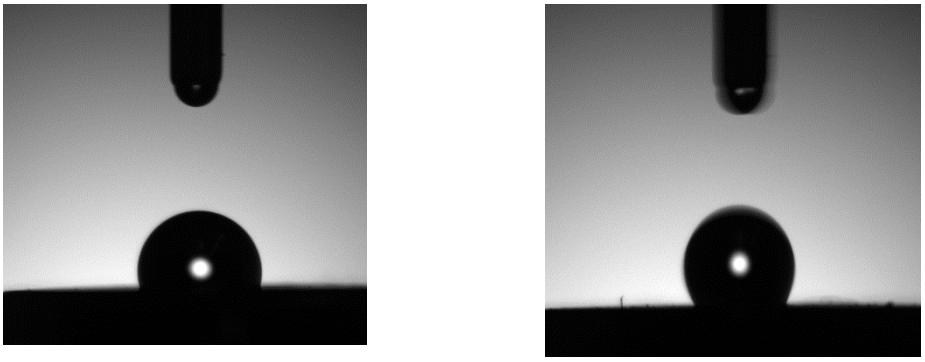


Figure S2. Contact angle measurements of A) GC electrode modified with POT layer; B) - GC electrode modified with POT-MWCNTs layer.

Table S1.

Comparison of electrochemical and analytical parameters offered by different by all-solid-state sensors of different arrangements.

	MWCNTs-POT This work	**CW [1]**	**CF-G[1]**	**PEDOT[1]**	**PANI[1]**	**POT[1]**	**GRAPHENE[2]**	**CB[3]**	**MWCNTs(CMC)[4]**	**[TbuPPCo-(II)]/[TbuPCCo(III)(PPh3)] with MWCNTs[5]**
Mg^{2+}	**-3.7 ± 0.4**	-3.5±0.3	-3.7±0.3	-3.6±0.2	-3.6±0.3	-3.4±0.4	-4.5±0.3	− 5.5±0.2	− 4.0±0.2	− 3.7±0.4
Ca^{2+}	**-3.6 ± 0.4**	-3.5±0.3	-3.7±0.3	-3.5±0.3	-3.6±0.3	-3.4±0.4	-3.6±0.2	−5.4±0.2	−3.9±0.6	−3.2±0.3
H^{+}	**-4.6 ± 0.3**	-4.5±0.2	-4.6±0.1	-4.2±0.3	-4.6±0.3	-4.5±0.3	-	-	-	-4.3±0.4
Na^{+}	**-3.5 ± 0.1**	-3.4±0.2	-3.5±0.2	-3.1±0.2	-3.5±0.1	-3.1±0.1	-4.5±0.3	− 3.5±0.2	− 3.4 ± 0.1	− 3.7±0.1
slope±SD (mV/dec)	**56.3±0.4**	61.2±0.7	60.0±1.8	55.2±1.7	59.2±1.2	59.8±0.5	59.2±0.1	59.1±0.2	57.3±0.6	55.7±0.7
linear range	**10^{-1}-10^{-6}**	10^{-1}-10^{-6}	10^{-1}-10^{-7}	10^{-1}-10^{-6}	10^{-1}-10^{-6}	10^{-1}-10^{-7}	10^{-1}-$10^{-4.5}$	-	10^{-1}-10^{-6}	10^{-1}-10^{-7}
detection limit [M]	**$10^{-6.8}$**	$10^{-6.5}$	$10^{-7.1}$	$10^{-6.3}$	$10^{-6.6}$	$10^{-6.8}$	10^{-5}	$10^{-6.4}$	$10^{-6.4}$	$10^{-6.9}$
resistance [Ω]	**10^{5}**	8.8x10^{6}	3.0x10^{6}	1.8x10^{6}	1.1x10^{6}	2.5x10^{6}	-	1.2x10^{6}	1x10^{6}	6.2x10^{6}
capacitance [F]	**2x10^{-4}**	2x10^{-6}	3x10^{-5}	9x10^{-5}	2x10^{-5}	1x10^{-4}	-	5.1x10^{-5}	-	1.5x10^{-5}

MWCNTs-POT - multiwalled carbon nanotubes- poly(octylthiophene) nanocomposite, **CW** - coated wire, **CF-G** - carboxy-functionalized graphene, **PEDOT** - poly(3,4-ethylenodioxythiophene), **POT** - regioregular poly(octylthiophene), **CB** - carbon black, **MWCNTs(CMC)** - multi-walled carbon nanotubes dispersion in sodium carboxymethylcellulose, **[TbuPPCo(II)]/[TbuPCCo(III)(PPh3)] with MWCNTs** - 5,10,15,20-tetrakis(4-tert-butylphenyl)porphyrin and 5,10,15-tris(4-tert-butylphenyl)corrole Co complexes with multi-walled carbon nanotubes

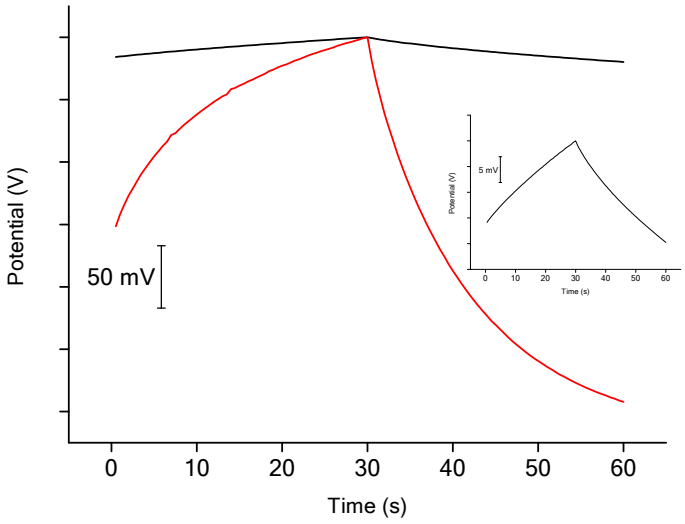


Figure S3. Results of chronopotentiometric experiments performed for glassy carbon substrate electrode covered with (red line) POT or (black line) POT-MWCNTs layer recorded in 10^{-3} M KCl, applying cathodic / anodic current of 10 nA. The experimental curves were shifted to give the same value at the moment of polarization change. Inset – magnified trace for POT-MWCNTs composite scale bar is 5 mV.

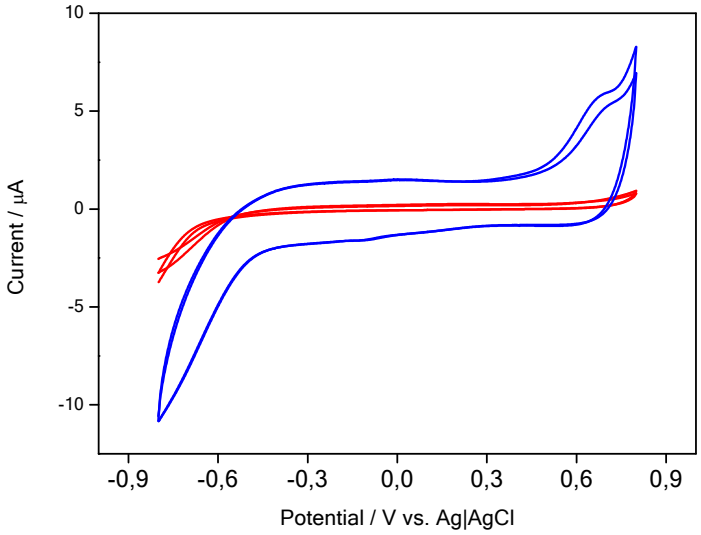


Figure S4. Cyclic voltammograms recorded for (red line) POT or (blue line) POT-MWCNTs layer coated on glassy carbon supporting electrode in 10^{-3} M KCl, scan rate 50 mV/s.

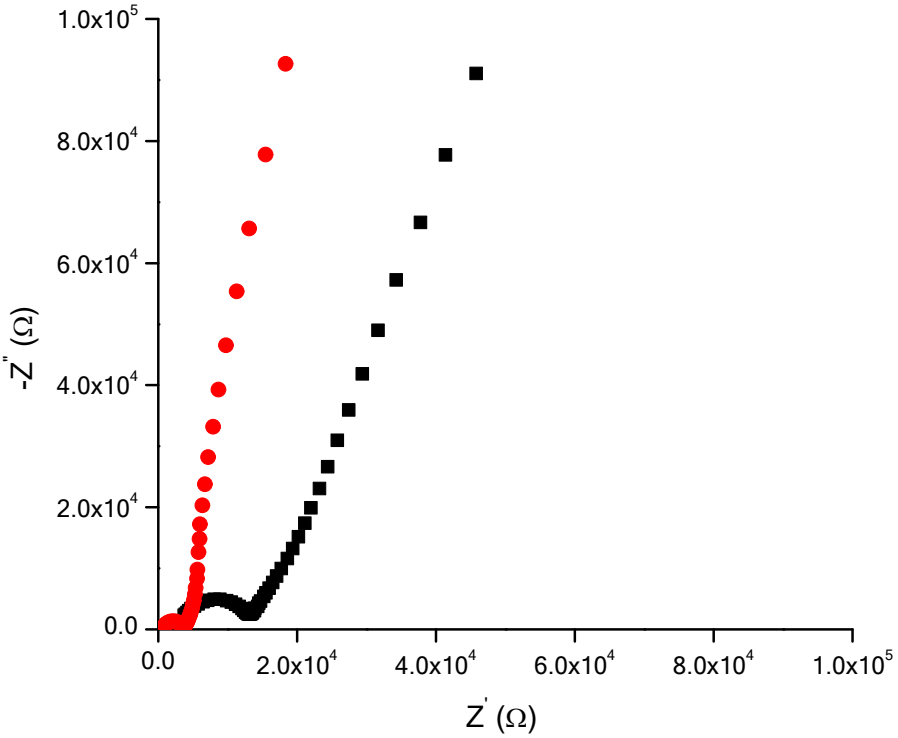


Figure S5. EIS spectra of (■) POT and (●) POT-MWCNTs layer recorded in 10^{-3} M KCl solution, in the frequency range from 0.01 to 10^5 Hz, using an amplitude of 50 mV at a potential of 0.5V.

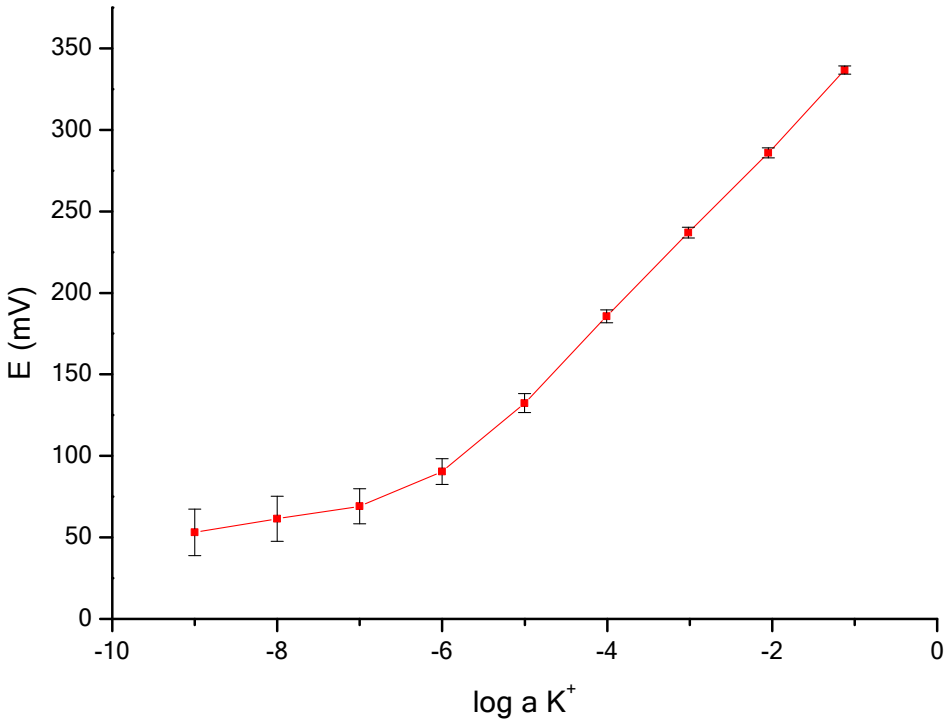


Figure S6. Potentiometric response of potassium-selective electrodes with POT-MWCNTs composite transducer recorded in KCl solutions mean potential values ± SD recorded over 6 calibrations performed during one week.

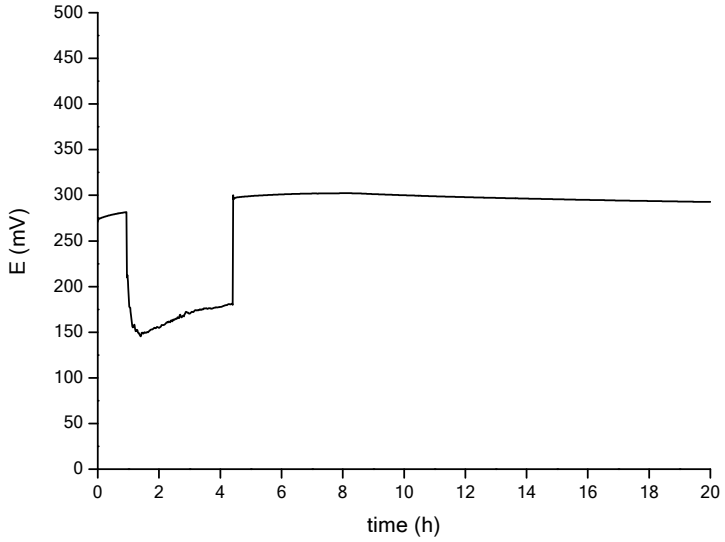
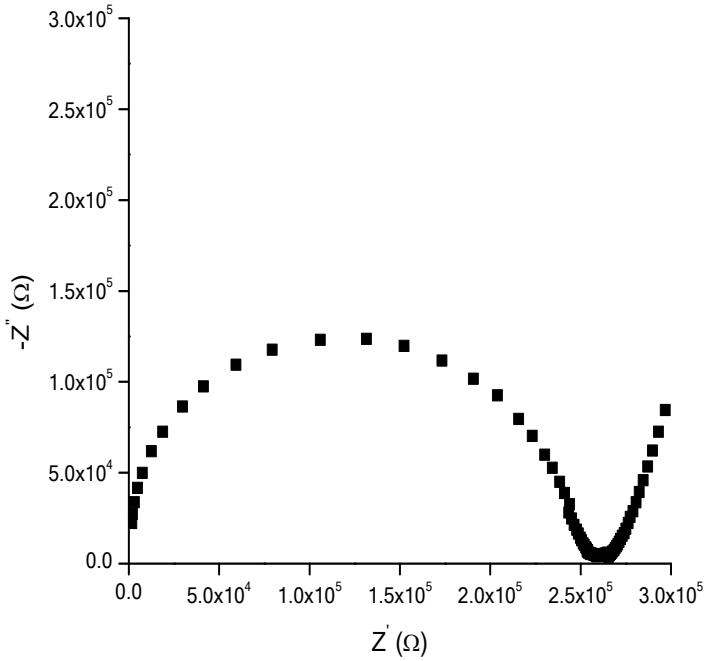


Figure S7. Results of water layer test experiment performed for all-solid-state sensor with POT-MWCNTs transducer recorded in 10^{-3} M KCl solution, 10^{-3} M NaCl and again in 10^{-3} M KCl solution.

A)



B)

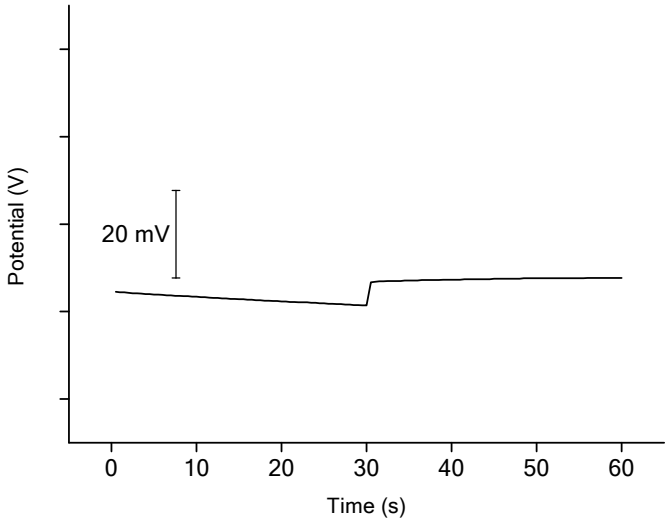


Figure S8. A) EIS spectrum recorded for all-solid-state potassium selective electrode with POT-MWCNTs transducer recorded in 0.1 M KCl solution, in the frequency range from 0.01 to 10^5 Hz, using an amplitude of 50 mV at a potential of 0.5V. B) Chronopotentiometric experiments results performed for all-solid-state potassium selective electrode with POT-MWCNTs transducer recorded in 0.1 M KCl solution using current $1 \cdot 10^{-8}$ A.

References

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