



The works of Frumkin Institute of Physical Chemistry and Electrochemistry on the creation of the new generation fuel cells

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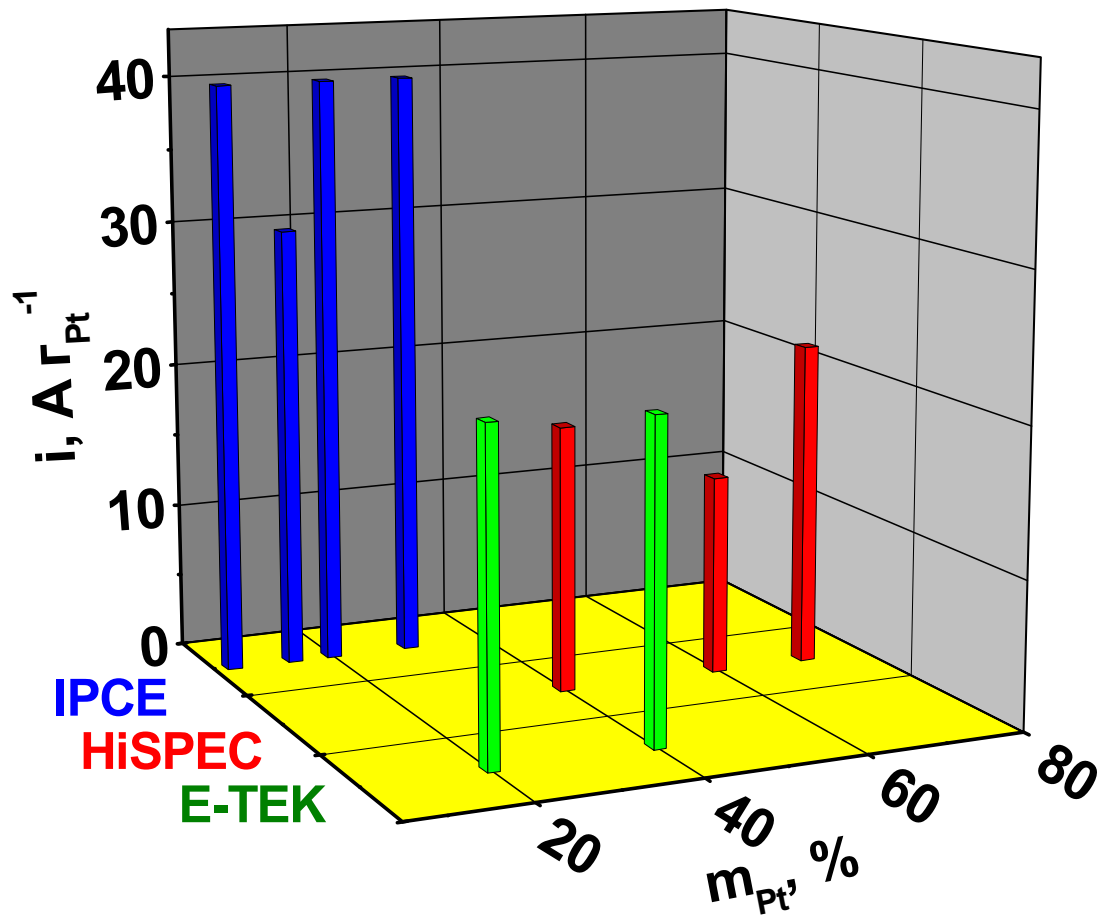
Goal directions of works in IPCE RAS

- **Decrease of platinum loading or refusal of its application;**
- **Lowering or full elimination of necessity of special pretreatment of gaseous reagents;**
- **Using hydrogen with CO admixtures;**
- **Replacement of hydrogen by alternative liquid fuel – ethanol (bioethanol).**



Low-temperature (60 – 80°C) hydrogen-air FC

- Perfluorinated electrolyte Fumion[®]
- Membrane F 950
- Catalysts based on platinum
- Hydrogen and air at atmospheric pressure



The comparison of specific activity for cathodic catalysts

PtCoCr (IPCE) and commercial **Pt (HiSPEC)** and **Pt (E-TEK)**.



Device for MEA formation

April 23, 2008



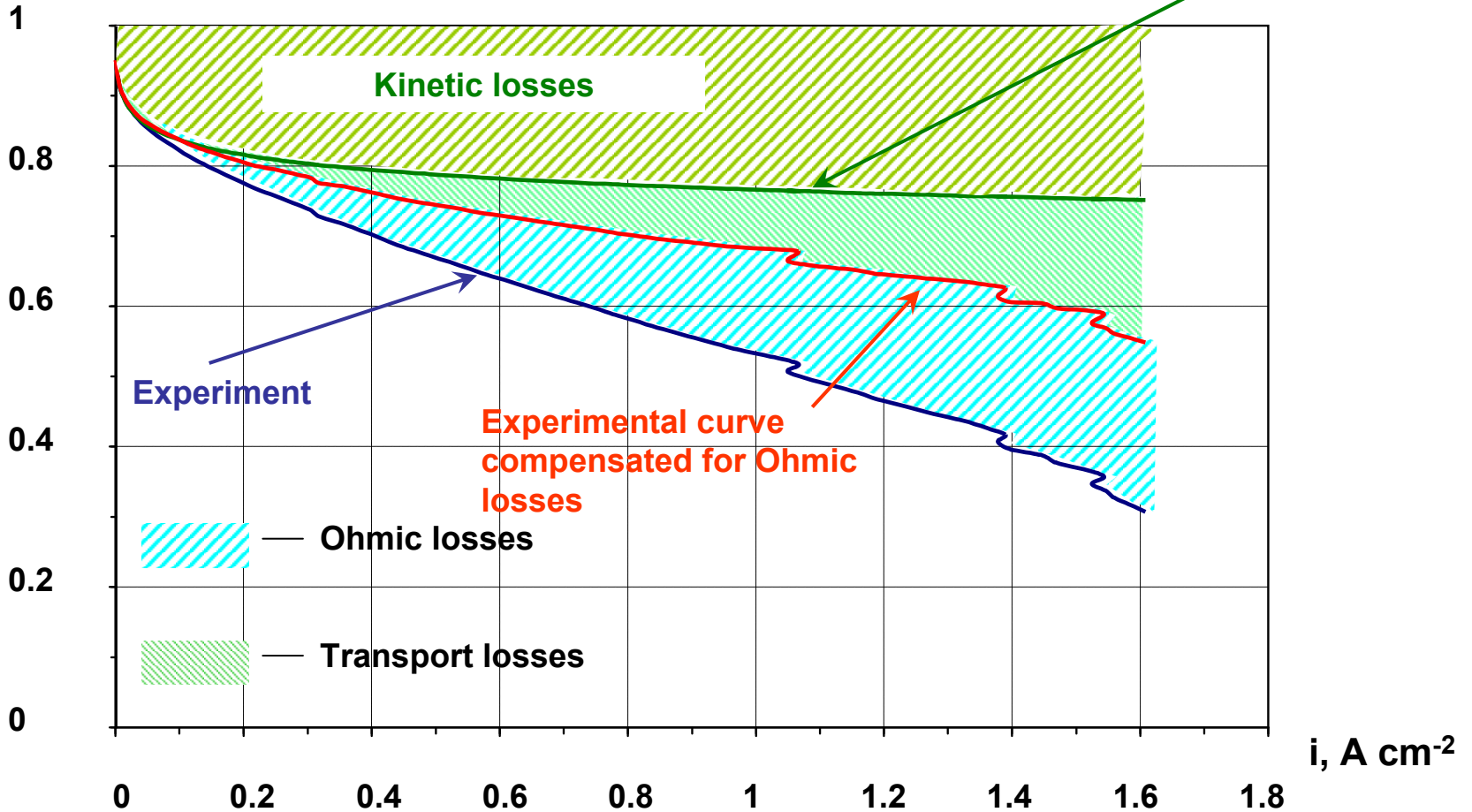
MEA test stations

April 23, 2008

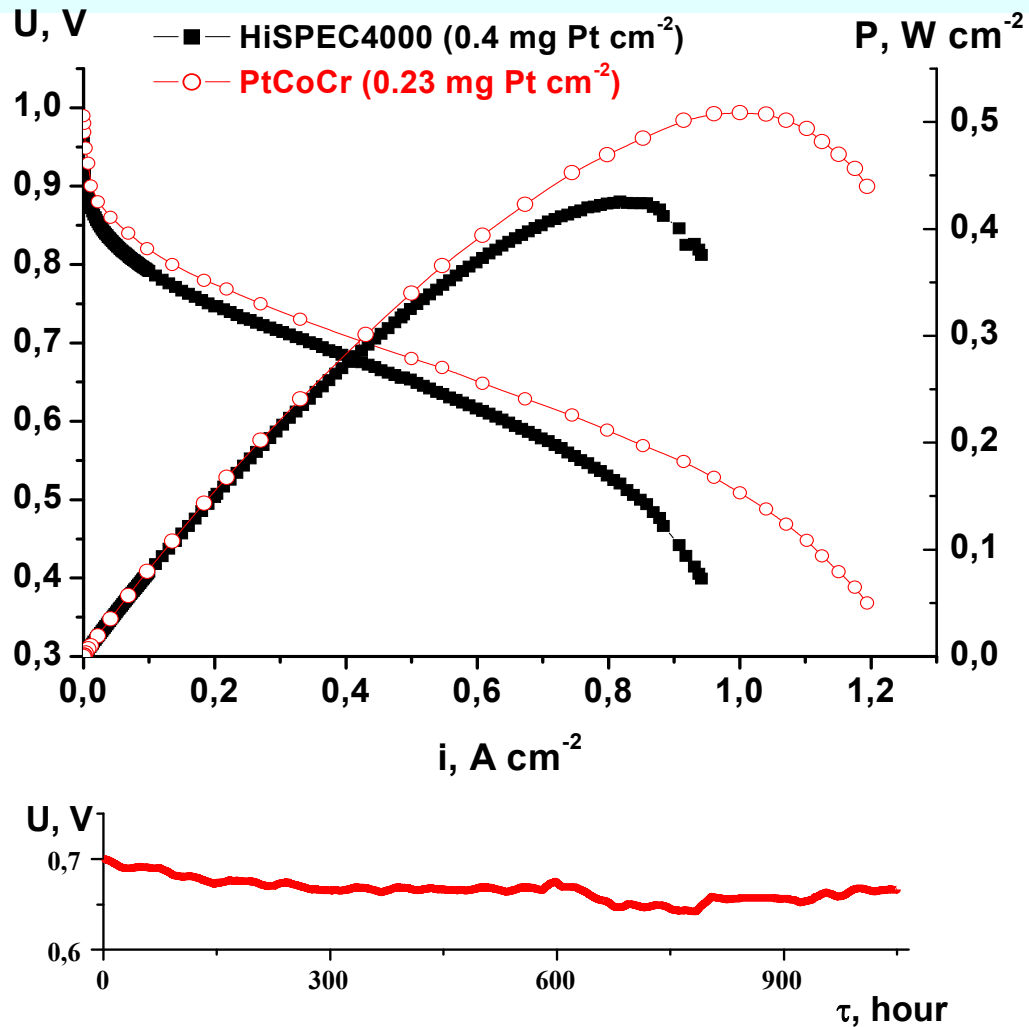


U, V

Extrapolated kinetic curve



Separation of kinetic, Ohmic and transport losses in hydrogen-air FC with membrane F 950, ambient gas pressure

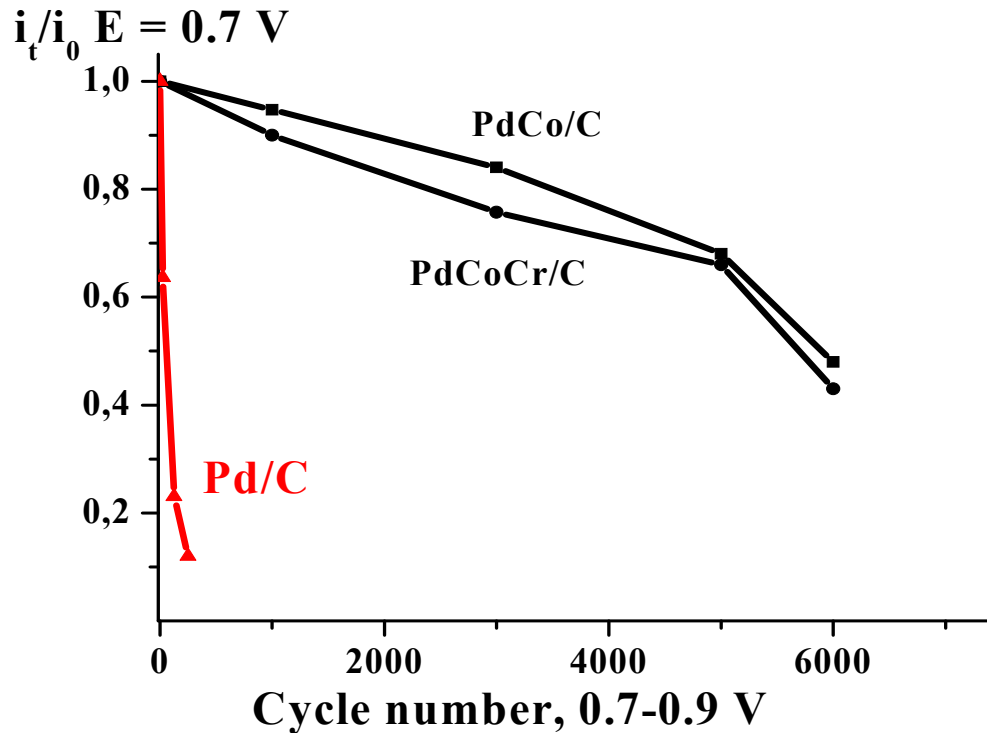


Discharge curves of hydrogen-air FC with MEAs based on F-950 membranes, 65 °C and life testing at $i=0.4 \text{ A cm}^{-2}$

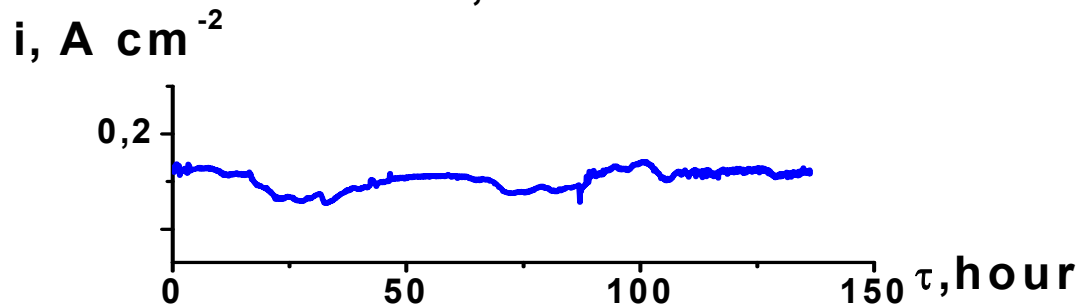
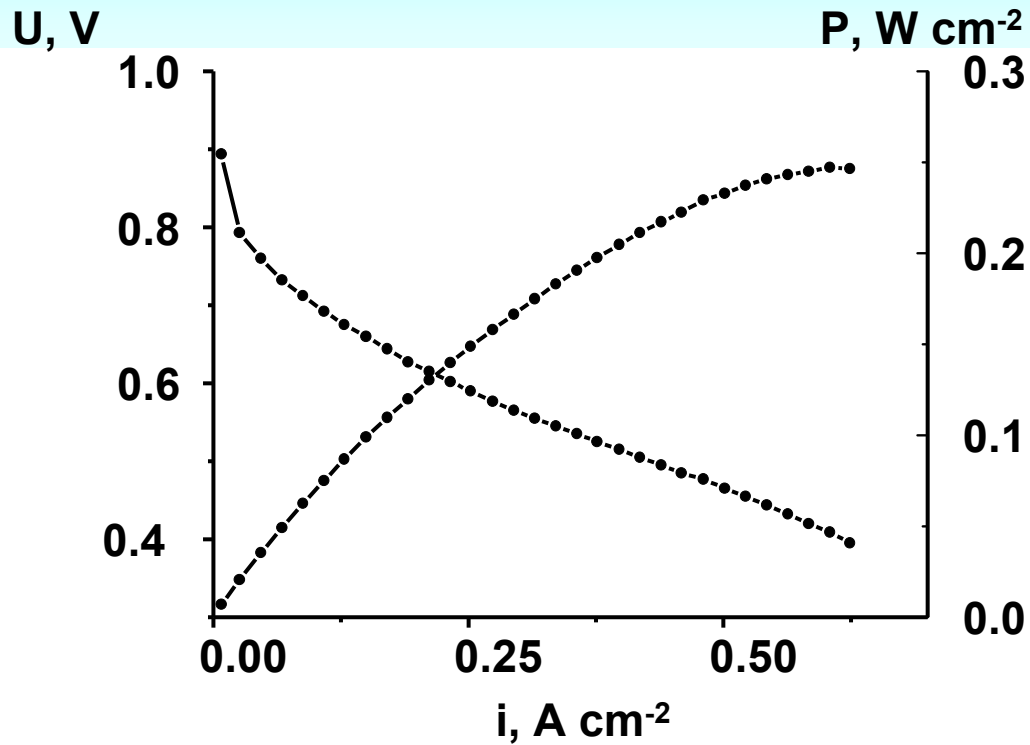


Low-temperature (60 – 80 °C) hydrogen-air FC **without usage of platinum**

- Perfluorinated electrolyte Nafion[®] . Membrane N 112
- Cathode: PdM, RuMX (M=Co, Cr, Fe, Ni); X=Se
- Anode: PdM, (M=Ru, Au, Mo)
- Hydrogen and air at atmospheric pressure



Relative decrease of activity of catalysts based on palladium in dependence on time of corrosion action



Discharge curves hydrogen-air FC with PdRu and PdCo catalysts, 65 °C and life testing at U=0.6 V

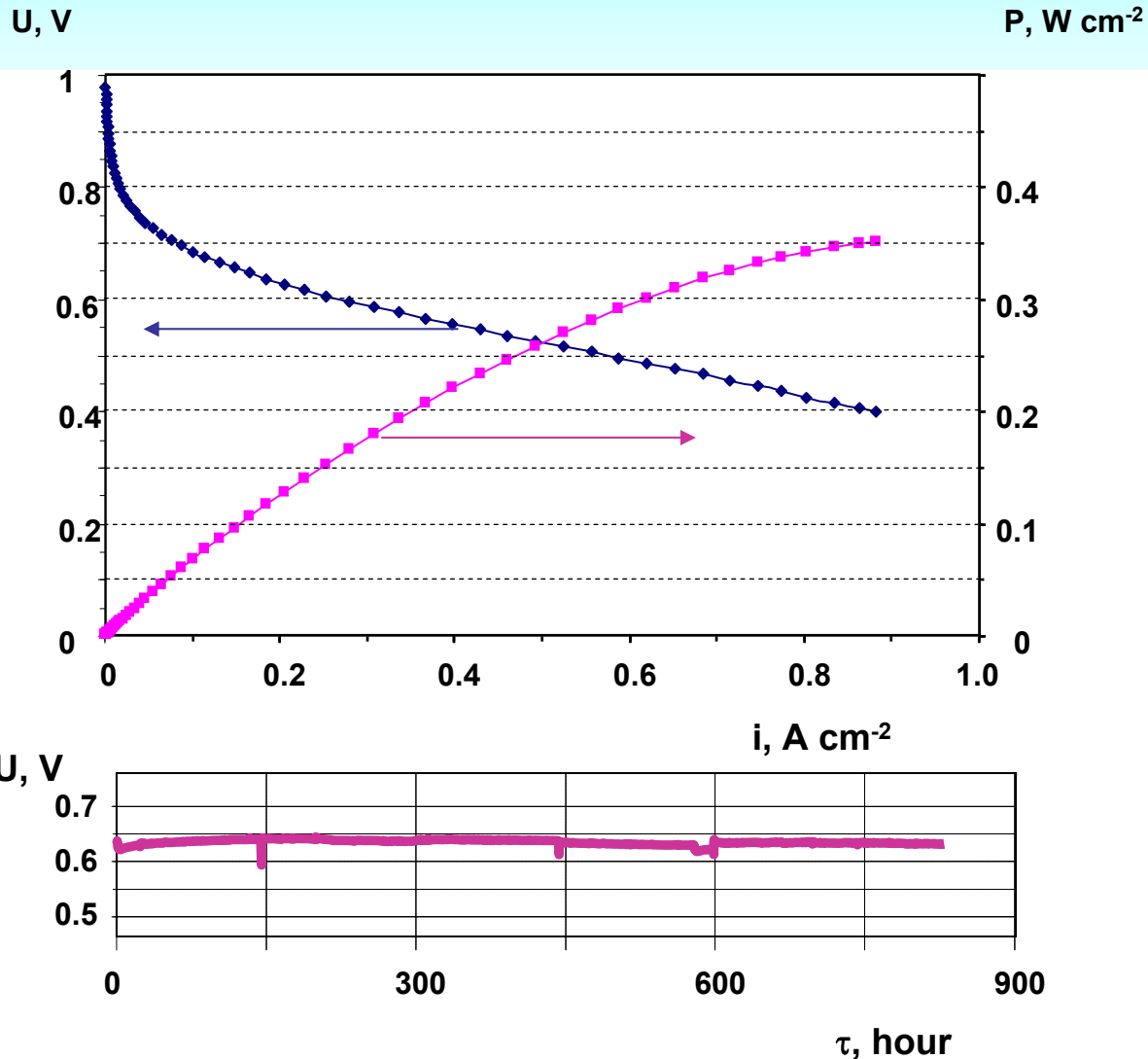


Middle-temperature(160-180 °C) hydrogen-air FC

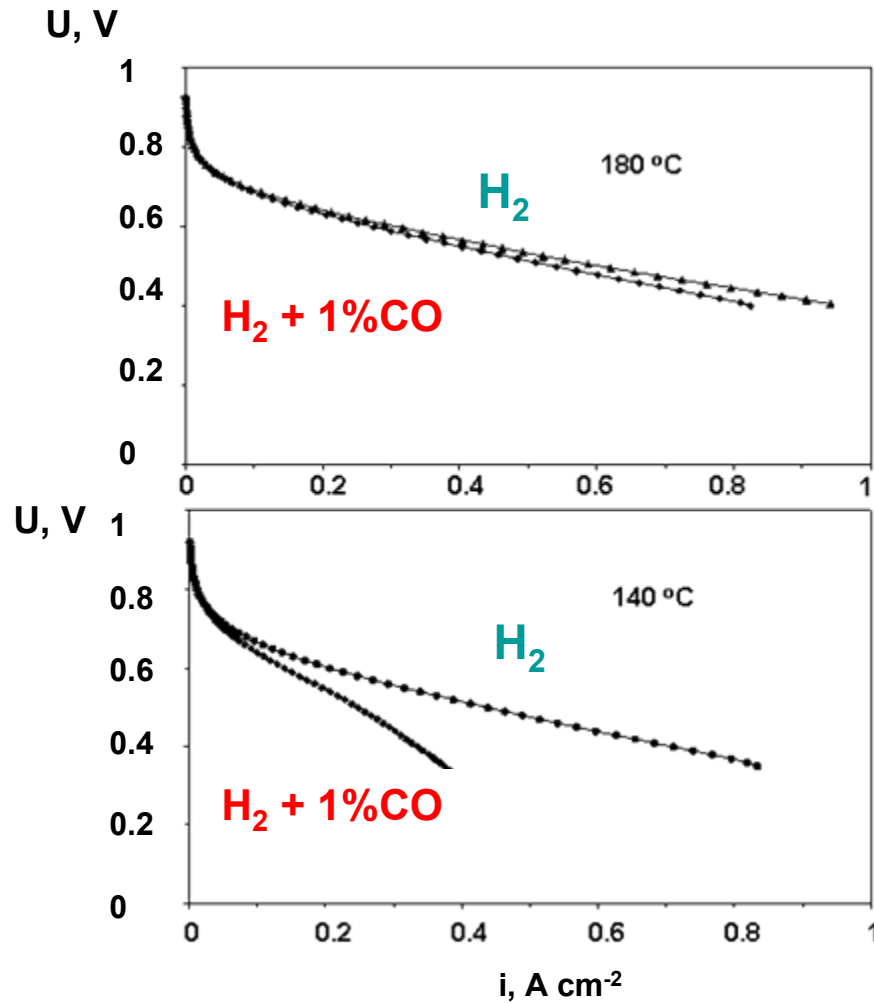
- OM-PBI membrane, electrolyte 90% H_3PO_4



- Catalysts based on Pt
- Hydrogen and air at atmospheric pressure,
without special pretreatment



Discharge curves hydrogen-air FC with OM-PBI membrane at atmospheric pressure without gas humidifying, 160 °C and life testing at $i=0.2 \text{ A cm}^{-2}$

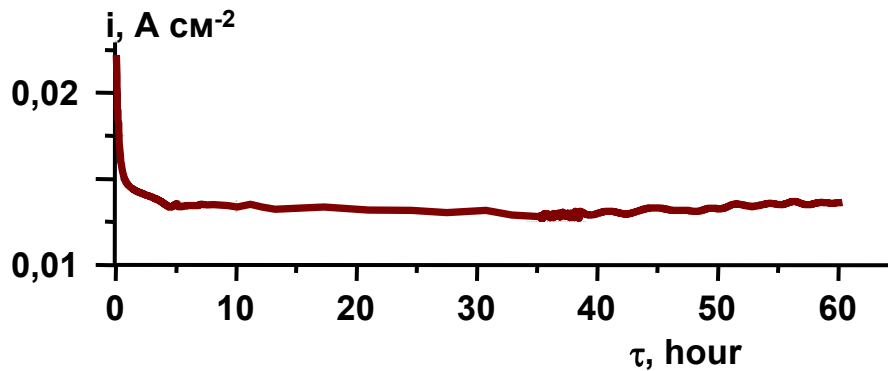
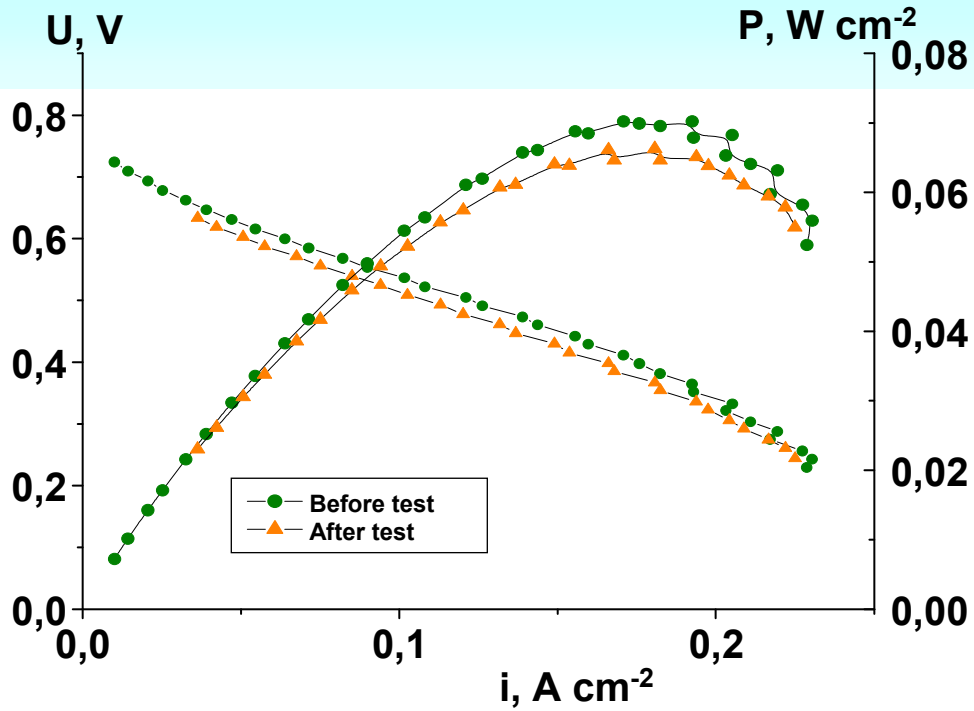


Parameters of hydrogen-air FC with OM-PBI membrane at operation with pure hydrogen and with 1% CO in hydrogen gas



Ethanol-oxygen (air) FC

- Membrane: perfluorinated N 117; hydrocarbonaceous ST850
- Catalysts based on Pt
- Cathode: PtX, (X= Bi, S, P)
- Anode: PtM, (M=Ru, Sn, Sb)



Discharge curves ethanol-oxygen FC with ST-850 membrane and catalysts Pt_3Sn and PtBi , 70°C and life testing at $U=0.6 \text{ V}$



**Авторы выражают благодарность Президиуму РАН,
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