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Annotation. *Polyethylene oxide (PEO) gel polymer electrolytes (GPEs) were prepared using tetrapropylammonium iodide (TPAI). The mass fraction (TPAI) in the electrolyte was varied to increase the productivity of the solar cell. It increased the ionic conductivity of the electrolyte at room temperature from 8.426* $\frac{1}{(\mathrm{m0hm}*\mathrm{sm})}$ *and 373K temperature to 18.117* $\frac{1}{(\mathrm{m0hm}*\mathrm{sm})}$*. The increase in ionic conductivity with the addition of TPAI salts was associated with an increase in the diffusion coefficient, mobility, and density of charge carriers.*

Keywords*: dye-sensitized solar cell, dye-sensitized solar cells, photoelectric electrode, loop electrode, photoanode, electrolyte, polymer electrolyte gel.*

In this paper, we have prepared various solar cells with different mass fractions of gel polymer electrolyte (GPE) and will present its impact on the performance of the DSSC. The polymer of choice here is polyethylene oxide (PEO), which is a synthetic polymer with $–CH_2CH_2O–$ [1].

The composition of the gel-polymer electrolyte salt: Tetrapropylammonium iodide TPAI, ethylene carbonate EC, propylene carbonate PC, polyethylene oxide PEO, dissolved in dimethylformamide DMF [2]. Table 1 shows the composition of the components in the GGE.

Table 1. Composition of the components in the GPE

TPAI		PEO		PC		EC		DMF		I_2	
gr	%	gr	%	Gr	%	gr	%	gr	%	gr	%
0.05	4.33	0.1	8.65	0.25	21.65	0.25	21.65	0.5	43.29	0.005	0.43
0.10	8.27	0.1	8.26	0.25	20.66	0.25	20.66	0.5	41.32	0.010	0.83
0.15	11.86	0.1	7.91	0.25	19.76	0.25	19.76	0.5	39.53	0.015	1.18
0.2	15.15	0.1	7.58	0.25	18.94	0.25	18.94	0.5	37.88	0.02	1.52
0.25	18.18	0.1	7.27	0.25	18.18	0.25	18.18	0.5	36.37	0.025	1.82

The electrical conductivity of the gel-polymer electrolyte was studied by the method of electrochemical impedance spectroscopy. Ionic conductivity (σ) for each sample was calculated by the formula (1) [3].

$$\sigma = \frac{l}{R*S} \qquad (1)$$

where l and S are the thickness of the electrolyte sample and the contact area of the electrolyte, respectively.

As it is known, ionic conductivity plays an important role in the production of higher quality polymer electrolytes [4,5]. The conductivity of the gel electrolyte, the dependence of the electrical conductivity on the temperature at 0.25 g mass fraction, is shown in Fig. 1.

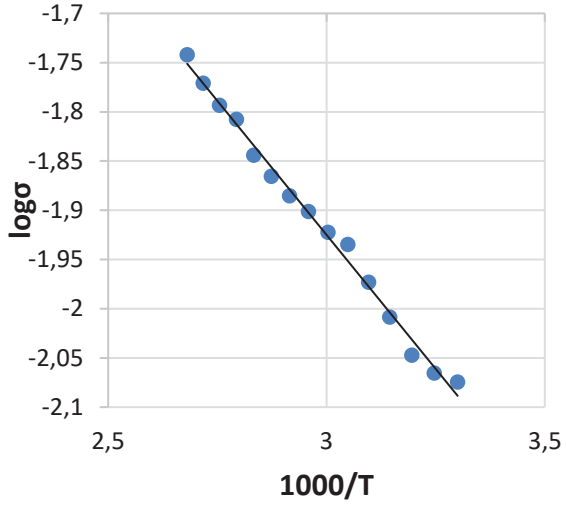

Fig. 1 Dependence of electrical conductivity of GPE from temperature at 0.25g TPAI

It can be seen from the figure that the electrical conductivity increases linearly with increasing temperature, i.e., it has an activation character at activation energies of about ΔE = 0.11 eV. The activation energy ΔE for each sample was calculated using the formula (2).

$$\sigma = \sigma_0 \cdot \exp\left(-\frac{\Delta E}{kT}\right) \qquad (2)$$

Table 2 shows the values of the activation energies of GPE with different mass fractions:

Table 2 - dependence of the activation energy of GPE on the mass fraction of TPAI

Mass fraction of TPAI, gr	0.25	0.2	0.15	0.1	0.05
ΔE, eV	0,114	0,116	0,097	0,097	0,128

Since with increasing temperature the vibrational energy of the segmental motion acts against the hydrostatic pressure created by neighboring atoms, the electrical conductivity increases with temperature, mainly due to an increase in the free volume for the movement of ions through the polymer backbone. Table 3 shows the values of volume resistance and electrical conductivity of GPE at 0.25 g TPAI at various temperatures. Bulk resistance decreased with increasing temperature, while electrical conductivity tended normally and increased with increasing temperature, which provided an increase in conducting ions.

Table 3- Values of volume resistance and electrical conductivity of GPE

Temperature, K	**303**	**313**	**323**	**333**	**343**	**353**	**363**	**373**
Bulk resistance R, Ohm	14,9	14	11,8	10,5	9,64	8,77	7,8	6,93
Conductivity σ, $\frac{1}{\text{mOhm}*\text{sm}}$	8,426	8,968	10,64	11,957	13,024	14,316	16,096	18,117

Measurements of the incident photons to current conversion efficiency (IPCE) were obtained using a NewportModel 70528 Oriel monochromator illuminator. The IPCE value indicates how much current was produced by the cell when it was illuminated by photons of a given frequency. The IPCE plots for DSSCs using the highest conductivity GGE under illumination at different light wavelengths are shown in Fig. 2. The most efficient DSSC in the GGE system exhibits the highest IPCE at 41.1%.

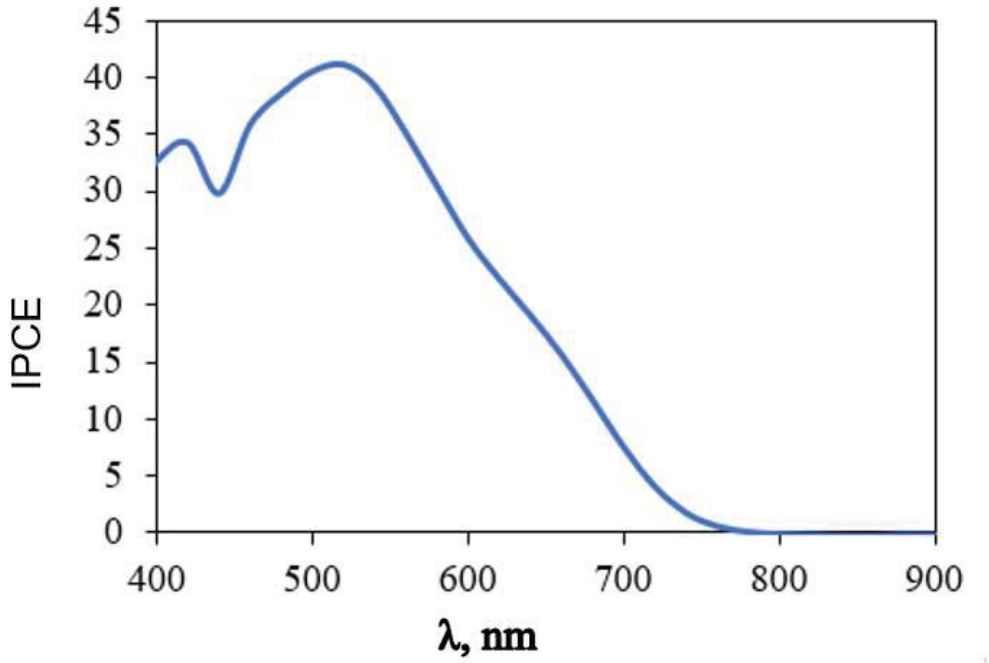

Fig.2. IPCE plot using the highest conductivity DSSC with GPE

A method for the preparation of a new conductive polymer electrolyte consisting of a PEO polymer by including TPAI and I^2 salts has been developed. The electrical conductivity of this material has been investigated using the methods of impedance spectroscopy of alternating current. It was shown that the value of ionic conductivity increases with an increase in the weight ratio of TPAI salts, and the maximum value of ionic conductivity is 0.018117 $\frac{1}{0hm*\text{sm}}$ for an electrolyte with 0.25g TPAI at a temperature of 373K. It was determined that the maximum ionic conductivity of DSSC solar cells corresponds to the mass fraction 0.25g TPAI.

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