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9. ChF1 - 2 kol (1), 12 pkt, 24.01.21

$$1. \Delta H^\circ = 271,54 - 45,94 - 36,29 = 189,31 \text{ kJ}/\text{mol}$$

$$\Delta S^\circ = -112,81 + 192,77 + 198,7 = 278,66 \text{ J/K-mol}$$

$$K(650) = 0,220 \Leftrightarrow K = \exp\left[-\frac{\Delta H^\circ}{RT} + \frac{\Delta S^\circ}{R}\right]$$

W warunkach r-qi:

$$\frac{P^2 X_{NH_3} \cdot X_{HBr}}{P_0} = K \Rightarrow \frac{P^2 \xi^2}{P_0 (n_p + 2\xi)^2} = K$$

$$P = \frac{(n_p + 2\xi)RT}{V}$$

$$\sum n_i = n_p + 2\xi \quad n_p - \text{ilosc mol w powietrzu}$$

$$\text{Po podstawieniu: } K = \left(\frac{RT\xi}{P_0 V}\right)^2 \Rightarrow V = \frac{RT\xi}{P_0 K^{1/2}}$$

$$\text{Dla } \alpha = \frac{\xi}{n_p} \quad V = \frac{RT \alpha n_p}{P_0 K^{1/2}} = \frac{8,314 \frac{\text{J}}{\text{mol K}} \cdot 650 \text{ K} \cdot 0,2 \cdot 0,06126 \text{ mol}}{1 \cdot 10^5 \frac{\text{Nm}^3}{\text{bar}} (0,22)^{1/2}} \cdot 10^{-3} \frac{\text{dm}^3}{\text{bar}}$$

$$V = 1,41 \text{ dm}^3$$

$$P_2 = \frac{(n_p + 2\xi)RT}{V} = \frac{n_p RT}{V} + \frac{2 \alpha n_p RT}{V} = P_1 \frac{V_1}{V_2} + \frac{2 \alpha n_p RT}{V_2} = \left(2 \cdot 1,01325 \cdot \frac{0,2}{1,41} + \frac{2 \cdot 0,2 \cdot 0,06126 \cdot 8,314 \cdot 650}{1,41 \cdot 10^{-3}}\right) \text{ bar}$$

$$n_p = \frac{6,09}{97,949} \text{ mol} = 0,06126 \text{ mol}$$

$$P_2 = 1,23 \text{ bar}$$

2. Stanek elektrolityczny znajduje się ze względem relacji temperatury roznicezalnosci

$$C_6(T_1) : C_7(T_2)$$

x_1	T_1 / K	T_2 / K
0,60	168,10	166,14
0,55	166,55	168,09

$$T_1 = \left(1/T_{T_1} - \frac{RT_{T_1}}{\Delta H_{T_1}}\right)^{-1}$$

$$\Delta H_{T_1} = 13,08 \text{ kJ/mol}$$

$$T_{T_1} = 177,8 \text{ K}$$

$$T_2 = \left(1/T_{T_2} - \frac{RT_{T_2}}{\Delta H_{T_2}}\right)^{-1}$$

$$\Delta H_{T_2} = 14,04 \text{ kJ/mol}, T_{T_2} = 182,6 \text{ K}$$

Poniewaz w przedziale $0,55 < x_1 < 0,60$ zauważajac iż relacje powidłydla elektrolityczny $0,55 < x_1 < 0,60$ Oszacowana temperatura elektrolityczny: $T^E \approx \frac{1}{2} (168,1 + 166,55) \text{ K} = 167 \text{ K}$

$$3. \Delta H^\circ = 138,41 - 20,6 - 110,5 = 7,31 \text{ kJ/mol}; \Delta S^\circ = -231,57 - 130,68 + 205,81 + 197,66 = 41,22 \text{ J/K-mol}$$

$$K(320) = 9,118$$

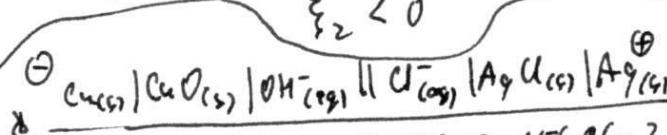
W stanie r-qi: $\frac{x_3 x_4}{x_1 x_2} = K \Rightarrow \frac{\xi^2}{(1-\xi)^2} = K \quad 0 \leq \xi \leq 1$

n_i^o	n_i	x_i	x_i
COS	1	$1 - \xi$	$(1 - \xi)/2$
H ₂	1	$1 - \xi$	$(1 - \xi)/2$
H ₂ S	0	ξ	$\xi/2$
CO	0	ξ	$\xi/2$

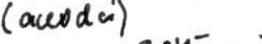
$$\sum n_i = 2$$

$$\xi = \frac{\pm K^{1/2}}{1 \pm K^{1/2}} \Rightarrow \xi_1 = \frac{9,118^{1/2}}{1 + 9,118^{1/2}} = 0,7412 \Rightarrow x_{H_2S} = x_{CO} = 0,3756$$

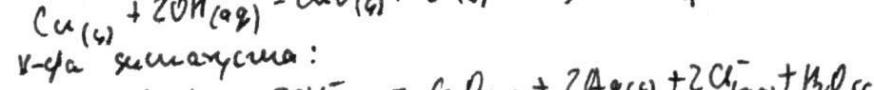
$$x_{CO} = x_{H_2} = 0,1244$$

4. (katoda) ~~AgCl + e^- = Ag(s) + Cl^- (aq)~~

(anoda)



V-qa sumaryczna:



Uwaga! R-qa na anodzie nie może zachodzić w środowisku kwasowym, bo CuO będzie reagować z kwasem.

$$\Delta H^\circ = 2 \cdot 127 + 2 \cdot 229,99 - 156,06 - 2 \cdot 167,16 - 285,83 = -62,23 \text{ kJ/mol}$$

$$\Delta S^\circ = -32,15 - 2 \cdot 96,3 + 10 \cdot 10,75 + 42,59 + 2 \cdot 46,6 + 2 \cdot 56,5 + 69,95 = 106,49 \text{ J/K-mol}$$

$$E^\circ = -\frac{\Delta G^\circ}{2F} = \frac{-\Delta H^\circ + T\Delta S^\circ}{2F} = \frac{62,23 \cdot 10^{-3} \text{ J/mol} + 320 \text{ K} \cdot 106,49 \cdot 10^{-3} \text{ J/K-mol}}{2 \cdot 96,485,3 \text{ C/mol}} = 0,90 \text{ V}$$

$$E = E^\circ - \frac{RT}{2F} \ln \left(\frac{a_{\text{Cl}^-}}{a_{\text{OH}^-}} \right)^2 = E^\circ - \frac{RT}{F} \ln \frac{a_{\text{Cl}^-}}{a_{\text{OH}^-}}$$