ENGINEERING CHEMISTRY

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Energy storage devices – Fuel cells

Class content:

- ***Efficiency of Fuel cells***

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Energy Storage devices- Fuel cells

Efficiency of a fuel cell:

- Thermodynamic efficiency is given by the ratio of **work output** to **heat input**
- Work output is **Gibb's free energy** ; heat input is **enthalpy change** of the cell reaction
- Gibb's free energy, ΔG - Measure of the electrical work done
- Enthalpy change, ΔH- Measure of the heat released during the reaction

$$\text{Efficiency \%} = \eta\% = \frac{\Delta G}{\Delta H} \times 100 = \frac{-nFE}{\Delta H} \times 100$$

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Energy Storage devices- Numericals

1. Calculate the efficiency of H_2-O_2 alkaline fuel cell
[Given: E_{Cell} =1.23 V, ΔH = -285.8 kJ/mole]

Sol.

$$\eta = \frac{\Delta G}{\Delta H} \times 100 = \frac{-nFE}{\Delta H} \times 100 = \frac{-2 \times 96500 \times 1.23}{-285.8 \times 1000} \times 100 = \mathbf{83.06\ \%}$$

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Energy Storage devices- Numericals

2. If E_{Cell} for H_2-O_2 alkaline fuel cell is 1.21 V and efficiency is 81.71%, calculate the heat evolved during the reaction.

Sol.

$$\eta = \frac{\Delta G}{\Delta H} \times 100$$

$$81.71 = \frac{-nFE}{\Delta H} \times 100 = \frac{-2 \times 96500 \times 1.21}{\Delta H} \times 100$$

$$\Delta H = -285.8 \text{ kJ}$$

3. Calculate the emf of H_2-O_2 alkaline fuel cell.
[Given: Efficiency of the cell =80.20 %, **ΔH** = -285.8 kJ/mole]

$$\eta = \frac{\Delta G}{\Delta H} \times 100 = \frac{-nFE_{cell}}{\Delta H} \times 100$$

$$80.2 = \frac{-2 \times 96500 \times E_{cell}}{-285.8 \times 1000} \times 100$$

$$E_{cell} = 1.18V$$

THANK YOU

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