



**Keywords:** *[Illegible text]*

**Introduction**

*[Illegible text]*

$$I = n_p I_{ph} - n_p I_{sat} \exp \left( \frac{q}{KTA} \frac{v}{ns} - 1 \right) \quad (1)$$

$$I_{sat} = I_{rr} \frac{T}{Tr} \exp \left( \frac{qe}{Ka} \frac{1}{Tr} \frac{1}{T} \right) \quad (2)$$

$$E_{gap} = Tr - Irr$$

**Methodology**

$$I_{ph} = I_{rr} \frac{T}{Tr} \exp \left( \frac{qe}{Ka} \frac{1}{Tr} \frac{1}{T} \right)$$

