

task_kyt15w11e3sempb2_with_calculation

Student Group

First Name	Surname	Matrikel Nr.

Table of Contents

Exercise E1 Equivalent linear Source (written test, approx. 7 % of a 60-minute written test, SS2023)

2

resistivity, power, exam ee1 SS2023

Exercise E1 Equivalent linear Source

(written test, approx. 7 % of a 60-minute written test, SS2023)

The conductivity of a dielectric material is a function of temperature. It is characterized by the Arrhenius equation: $\rho = \rho_0 \exp\left(\frac{E_a}{kT}\right)$, where ρ_0 is a pre-exponential factor, E_a is the activation energy, k is the Boltzmann constant, and T is the absolute temperature. A best fit would be a $B25 \pm 1500$ for between 20°C and 100°C .

Solution
The resistivity of the dielectric material is $\rho_{\text{PP}}(20^\circ\text{C}) = 10^{17} \Omega\text{m}$.

For the given material the temperature coefficients in the range of 20°C and 55°C

are given as $\alpha = -0.048 \text{ } 1/\text{K}$ and $\beta = +0.00057 \text{ } 1/\text{K}^2$.

$$\begin{aligned} R(55^\circ\text{C}) &= R(20^\circ\text{C}) \cdot (1 + \alpha \cdot \Delta T + \beta \cdot T^2 + \dots) \\ &= 80 \text{ G}\Omega \cdot (1 - 0.048 \text{ } 1/\text{K} \cdot (35 - 20 \text{ K}) + 0.00057 \text{ } 1/\text{K}^2 \cdot \Delta T^2) \end{aligned}$$

Calculate the resistance for the dielectric material for 20°C .

Solution

```
\begin{align*} R(20 \sim \rm ^\circ C) \&= \rho \cdot \frac{d}{A} \&= 10^{17} \sim \Omega \\ \rm m \cdot \frac{0.8 \cdot 10^{-6} \sim \rm m}{1 \sim \rm m^2} \end{align*}
```

From:

<https://wiki.mexle.te.hs-heilbronn.de/> - **MEXLE Wiki**

Permanent link:

https://wiki.mexle.te.hs-heilbronn.de/ee1/task_kyt15w11e3sempb2_with_calculation?rev=1696489084

Last update: **2023/10/05 08:58**

