task_kyt15w11e3sempb2_with_calculation

Student Group

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resistivity, power, exam ee1 SS2023

Exercise E2 Resistivity and temperature dependent Resistance
(written test, approx. 7 % of a 60-minute written test, SS2023)

[illegible] described by the [illegible] $B25 = 15000$ for [illegible] ~\rm °C$)

Result

Solution

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

\begin{align*} R(20 ~\rm °C) &= 80 ~\rm G\Omega \end{align*}

For the given material the temperature coefficients in the range of $20 ~\rm °C$ and $55 ~\rm °C$ are given as $\alpha =-0.048 ~\rm 1/K$ and $\beta=+0.00057 ~\rm 1/K^2$.

\begin{align*} R(55 ~\rm °C) &= R(20 ~\rm °C) \cdot (1+\alpha\cdot\Delta T + \beta\cdot T^2 + ...)\\ &= 80 ~\rm G\Omega \cdot (1-0.048 ~\rm 1/K \cdot(35 ~{\rm K}) + 0.00057 ~\rm 1/K^2\cdot\Delta (35 ~{\rm K})^2) \end{align*}

Calculate the resistance for the dielectric material for $20 ~\rm °C$.

Solution

$$\begin{align*} R(20 ~\rm °C) &= \rho\cdot {{d}\over{A}}\\ &= 10^{17} ~\Omega \rm m \cdot {{0.8\cdot 10^{-6} ~\rm m}\over{1 ~\rm m^2}} \end{align*}$$