

task_kyt15w11e3sempb2_with_calculation

Student Group

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Exercise E1 Resistivity and temperature dependent Resistance (written test, approx. 7 % of a 60-minute written test, SS2023)

The results of the correlation analysis revealed that the relationship between the surface area of the pores and the pore volume was described by the equation $V_p = 0.0001A_p + 0.0001$, where V_p is the pore volume (cm³/g) and A_p is the surface area (m²/g). The correlation coefficient was 0.9999, indicating a very strong positive correlation between the two variables. The results of the correlation analysis are shown in Table 1.

The resistivity of the dielectric material is $\rho_{\text{PP}}(20 \sim 100^\circ\text{C}) = 10^{17} \sim 10^{18} \Omega\cdot\text{cm}$.

For the given material the temperature coefficients in the range $0-420\text{ }^{\circ}\text{C}$ and $550-1000\text{ }^{\circ}\text{C}$ are given as $\alpha = -0.048\text{ }^{\circ}\text{C}^{-1}$ and $\beta = +0.00057\text{ }^{\circ}\text{C}^{-2}$.

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

Calculate the resistance for the dielectric material for $20 \text{ }^\circ\text{C}$.

Solution

$$\begin{aligned} R(20 \text{ }^\circ\text{C}) &= \rho \cdot \frac{d}{A} \\ &= 10^{17} \text{ }^\circ\text{C} \cdot \frac{0.8 \cdot 10^{-6} \text{ m}}{1 \text{ m}^2} \end{aligned}$$

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Last update: **2023/11/08 11:26**

