8.47 Measurement of the TE_{101} frequency response of an air-filled cubic cavity revealed that its Q is 2401. If its volume is 8 mm^3, what material are its sides made of? [Hint: See Appendix B.]

Solution:

According to Eq. (8.121), the TE_{101} resonant frequency of a cubic cavity is given by

$$f_{101} = \frac{3 \times 10^8}{\sqrt{2}a} = \frac{3 \times 10^8}{\sqrt{2} \times 2 \times 10^{-3}} = 106 \text{ GHz}.$$

Its Q is given by

$$Q = \frac{a}{3\delta_s} = 2401,$$

which gives $\delta_s = 2.78 \times 10^{-7}$ m. Applying

$$\delta_s = \frac{1}{\sqrt{\pi f_{101} \mu_0 \sigma_c}},$$

and solving for σ_c leads to

$$\sigma_c \approx 6.2 \times 10^7 \text{ S/m}.$$

According to Appendix B, the material is silver.