4.44 A 100 m long conductor of uniform cross-section has a voltage drop of 4 V between its ends. If the density of the current flowing through it is 1.4×10^6 (A/m^2), identify the material of the conductor.

Solution: We know that conductivity characterizes a material:

$$\mathbf{J} = \sigma \mathbf{E}, \qquad 1.4 \times 10^6 \text{ (A/m}^2\text{)} = \sigma \left(\frac{4 \text{ (V)}}{100 \text{ (m)}} \right), \qquad \sigma = 3.5 \times 10^7 \qquad \text{(S/m)}.$$

From Table B-2, we find that aluminum has $\sigma = 3.5 \times 10^7$ (S/m).