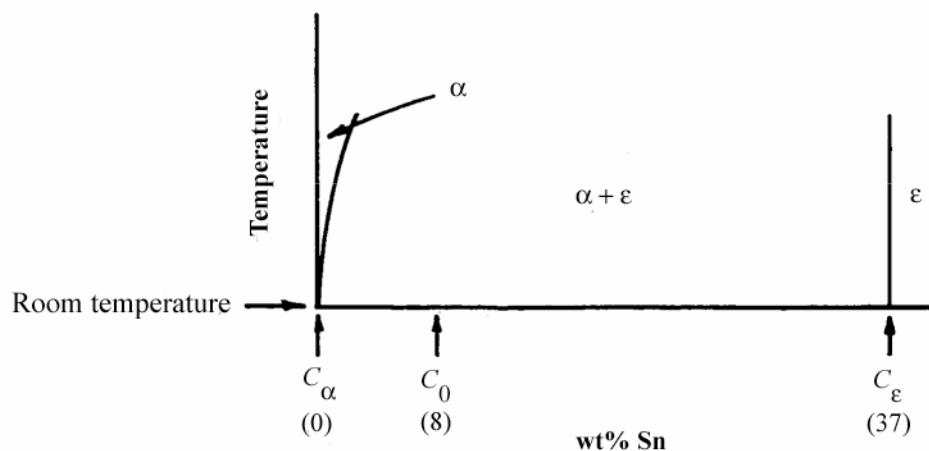


18.16 This problem asks for us to compute the room-temperature conductivity of a two-phase Cu-Sn alloy which composition is 89 wt% Cu-11 wt% Sn. It is first necessary for us to determine the volume fractions of the α and ϵ phases, after which the resistivity (and subsequently, the conductivity) may be calculated using Equation 18.12. Weight fractions of the two phases are first calculated using the phase diagram information provided in the problem.

We may represent a portion of the phase diagram near room temperature as follows:



Applying the lever rule to this situation

$$W_{\alpha} = \frac{C_{\epsilon} - C_0}{C_{\epsilon} - C_{\alpha}} = \frac{37 - 11}{37 - 0} = 0.703$$

$$W_{\epsilon} = \frac{C_0 - C_{\alpha}}{C_{\epsilon} - C_{\alpha}} = \frac{11 - 0}{37 - 0} = 0.297$$

We must now convert these mass fractions into volume fractions using the phase densities given in the problem statement. (*Note:* in the following expressions, density is represented by ρ' in order to avoid confusion with resistivity which is designated by ρ .) Utilization of Equations 9.6a and 9.6b leads to

$$V_{\alpha} = \frac{\frac{W_{\alpha}}{\rho'_{\alpha}}}{\frac{W_{\alpha}}{\rho'_{\alpha}} + \frac{W_{\epsilon}}{\rho'_{\epsilon}}}$$