

4.23 This problem asks us to determine the weight percent of Au that must be added to Ag such that the resultant alloy will contain 5.5×10^{21} Au atoms per cubic centimeter. To solve this problem, employment of Equation 4.19 is necessary, using the following values:

$$N_1 = N_{\text{Au}} = 5.5 \times 10^{21} \text{ atoms/cm}^3$$

$$\rho_1 = \rho_{\text{Au}} = 19.32 \text{ g/cm}^3$$

$$\rho_2 = \rho_{\text{Ag}} = 10.49 \text{ g/cm}^3$$

$$A_1 = A_{\text{Au}} = 196.97 \text{ g/mol}$$

$$A_2 = A_{\text{Ag}} = 107.87 \text{ g/mol}$$

Thus

$$C_{\text{Au}} = \frac{100}{1 + \frac{N_{\text{Ag}} \rho_{\text{Ag}}}{N_{\text{Au}} A_{\text{Au}}} - \frac{\rho_{\text{Ag}}}{\rho_{\text{Au}}}}$$

$$= \frac{100}{1 + \frac{(6.023 \times 10^{23} \text{ atoms/mol})(10.49 \text{ g/cm}^3)}{(5.5 \times 10^{21} \text{ atoms/cm}^3)(196.97 \text{ g/mol})} - \left(\frac{10.49 \text{ g/cm}^3}{19.32 \text{ g/cm}^3} \right)}$$

$$= 15.9 \text{ wt\%}$$