$$
\begin{gathered}
=\left(0.6 \times 10^{-8}\right)-(-150) \frac{\left[\left(0.6 \times 10^{-8}\right)-\left(1.25 \times 10^{-8}\right)\right](\Omega-\mathrm{m})}{-150^{\circ} \mathrm{C}-\left(-50^{\circ} \mathrm{C}\right)} \\
=1.58 \times 10^{-8}(\Omega-\mathrm{m})
\end{gathered}
$$

(b) For this part of the problem, we want to calculate $A$ from Equation 18.11

$$
\rho_{i}=A c_{i}\left(1-c_{i}\right)
$$

In Figure 18.8, curves are plotted for three $c_{i}$ values $(0.0112,0.0216$, and 0.0332$)$. Let us find $A$ for each of these $c_{i}$ 's by taking a $\rho_{\text {total }}$ from each curve at some temperature (say $0^{\circ} \mathrm{C}$ ) and then subtracting out $\rho_{i}$ for pure copper at this same temperature (which is $1.7 \times 10^{-8} \Omega-\mathrm{m}$ ). Below is tabulated values of $A$ determined from these three $c_{i}$ values, and other data that were used in the computations.

| $c_{i}$ | $1-c_{i}$ | $\rho_{\text {total }}(\Omega-\mathrm{m})$ | $\rho_{i}(\Omega-\mathrm{m})$ | $A(\Omega-\mathrm{m})$ |
| :---: | :---: | :---: | :---: | :---: |
| 0.0112 | 0.989 | $3.0 \times 10^{-8}$ | $1.3 \times 10^{-8}$ | $1.17 \times 10^{-6}$ |
| 0.0216 | 0.978 | $4.2 \times 10^{-8}$ | $2.5 \times 10^{-8}$ | $1.18 \times 10^{-6}$ |
| 0.0332 | 0.967 | $5.5 \times 10^{-8}$ | $3.8 \times 10^{-8}$ | $1.18 \times 10^{-6}$ |

The average of these three $A$ values is $1.18 \times 10^{-6}(\Omega-\mathrm{m})$.
(c) We use the results of parts (a) and (b) to estimate the electrical resistivity of copper containing 2.50 $\mathrm{at} \% \mathrm{Ni}\left(c_{i}=0.025\right)$ at $120^{\circ} \mathrm{C}$. The total resistivity is just

$$
\rho_{\text {total }}=\rho_{t}+\rho_{i}
$$

Or incorporating the expressions for $\rho_{t}$ and $\rho_{i}$ from Equations 18.10 and 18.11 , and the values of $\rho_{0}$, $a$, and $A$ determined above, leads to

$$
\begin{gathered}
\rho_{\text {total }}=\left(\rho_{0}+a T\right)+A c_{i}\left(1-c_{i}\right) \\
=\left\{1.58 \times 10^{-8}(\Omega-\mathrm{m})+\left[6.5 \times 10^{-11}(\Omega-\mathrm{m}) /{ }^{\circ} \mathrm{C}\right]\left(120^{\circ} \mathrm{C}\right)\right\} \\
+\left\{\left[1.18 \times 10^{-6}(\Omega-\mathrm{m})\right](0.0250)(1-0.0250)\right\} \\
=5.24 \times 10^{-8}(\Omega-\mathrm{m})
\end{gathered}
$$

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