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

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

$$\rho_i = Ac_i \left(1 - c_i\right)$$

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°C) and then subtracting out  $\rho_i$  for pure copper at this same temperature (which is 1.7 x 10<sup>-8</sup>  $\Omega$ -m). Below is tabulated values of A determined from these three  $c_i$  values, and other data that were used in the computations.

$c_i$	$1 - c_i$	$\rho_{total}\left(\Omega\text{-}m\right)$	ρ <sub>i</sub> (Ω-m)	$A(\Omega-m)$
0.0112	0.989	3.0 x 10 <sup>-8</sup>	1.3 x 10 <sup>-8</sup>	1.17 x 10 <sup>-6</sup>
0.0216	0.978	4.2 x 10 <sup>-8</sup>	2.5 x 10 <sup>-8</sup>	1.18 x 10 <sup>-6</sup>
0.0332	0.967	5.5 x 10 <sup>-8</sup>	3.8 x 10 <sup>-8</sup>	1.18 x 10 <sup>-6</sup>

The average of these three A values is  $1.18 \times 10^{-6}$  ( $\Omega$ -m).

(c) We use the results of parts (a) and (b) to estimate the electrical resistivity of copper containing 2.50 at% Ni ( $c_i = 0.025$ ) at120°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

$$\rho_{\text{total}} = (\rho_0 + aI) + Ac_i (1 - c_i)$$
$$= \left\{ 1.58 \text{ x } 10^{-8} (\Omega - \text{m}) + [6.5 \text{ x } 10^{-11} (\Omega - \text{m})/^{\circ}\text{C}](120^{\circ}\text{C}) \right\}$$
$$+ \left\{ [1.18 \text{ x } 10^{-6} (\Omega - \text{m})](0.0250)(1 - 0.0250) \right\}$$

$$= 5.24 \text{ x } 10^{-8} (\Omega - \text{m})$$

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