ENTROPY OF ALUMINUM AT LOW TEMPERATURES

A curve fit to experimental measurements of the heat capacity of one mole of alumin(i)um at low temperatures is

\[ C_V = aT + bT^3 \]  \hspace{1cm} (1)

where \( a = 0.00135 \text{ J K}^{-2} \) and \( b = 2.48 \times 10^{-5} \text{ J K}^{-3} \).

We can use this to work out the entropy from the formula

\[ S_f - S(0) = \int_0^{T_f} \frac{C_V(T)}{T} dT \]  \hspace{1cm} (2)

\[ = aT_f + \frac{b}{3}T_f^3 \]  \hspace{1cm} (3)

If we take \( S(0) = 0 \), we can evaluate the formula at a few temperatures. At \( T = 1 \text{ K} \), we have

\[ S(1) = 1.358 \times 10^{-3} \text{ J K}^{-1} \]  \hspace{1cm} (4)

In dimensionless form, we have

\[ \frac{S(1)}{k} = 9.84 \times 10^{19} \]  \hspace{1cm} (5)

At \( T = 10 \text{ K} \)

\[ S(10) = 0.0218 \text{ J K}^{-1} \]  \hspace{1cm} (6)

\[ \frac{S(10)}{k} = 1.58 \times 10^{21} \]  \hspace{1cm} (7)