- standard deviation about regression line, $s_r = \sqrt{\frac{s_{yy} - m\, s_{xx}}{N-2}} = \sqrt{\frac{96.69 - 4708^2 * 4.36*10^{-6}}{85-2}} =$ 0.0216;
- standard deviation of the slope, $s_m = \sqrt{\frac{s_r^2}{s_{xx}}} = \sqrt{\frac{0.0216^2}{4.36*10^{-6}}} = 10.36$;
- standard deviation of the intercept, $s_b = s_r * \sqrt{\frac{\sum x^2}{N\sum x^2 - (\sum x)^2}} = 0.0216 * \sqrt{\frac{0.000788}{85*0.000788 - 0.258^2}} =$ 0.0315;

- from y = c + mx, c = b = -11.44 and m= 4708.
- $\ln R = C + \frac{Eg}{2K_B}\frac{1}{T}$, therefore $\ln R = -11.44 + 4708\ \frac{1}{T}$
- $m = \frac{Eg}{2K_B}$,
- therefore $Eg = m*2K_B = 4\,708*2*8.617\times10^{-5} = 0.811$ eV.

~ As expected the plot was a linear graph.
~ The gradient was found to be large as well.
~ The calculated gap energy, Eg, of the unknown semiconductor is 0.811 eV.
~ The known, accepted value for Silicon (Si) semiconductor is 1.11 eV and that for Germanium (Ge) is 0.67 eV.
~ Therefore the unknown semiconductor is Germanium.
~
~ The difference of the computed value from the actual value suggests that there were some errors introduced.
~ Sources of errors in the experiment were possibly due to:
  - Random errors in the reading of the temperature from the analogue thermometer.
  - Moments were stirring speed was increased; it was difficult to take accurate resistance in time hence estimates were taken for those cases.
  - There could have been impurities in the semiconductor to affect the conductivity. Therefore the measured intrinsic gap energy would be slightly distorted.
~ Even though there were some sources of errors, the standard deviation about regression line, which represents the error, is so small that the results can be considered valid.

Conclusions

- The gap energy for the semiconductor is 0.811 eV.
- The sample semiconductor used is Germanium.

References

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