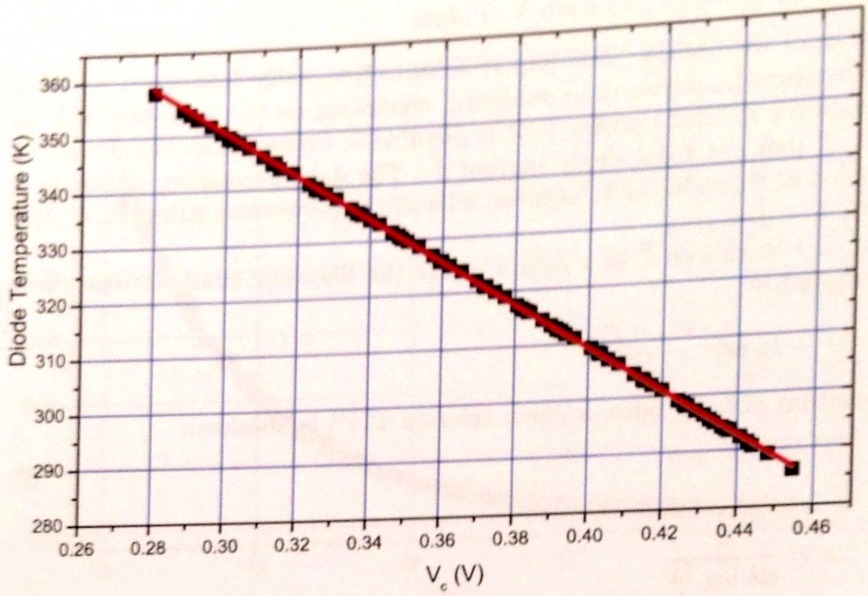

Figure 10. T as a function of V as calculated interpolating (see text) the 100 I–V curves analysed. The continuous curve represents the linear *fit* $T = -aV + b$. $E_G = -b/a = 1.161 \pm 0.002$ eV.

environment with suitable numerical packages. The methodology used is relatively simple, and is suitable for the undergraduate science and engineering laboratory. The four parameters of the modified Shockley, represented in eq.(7), are extracted and their values are found in quite good agreement with the literature.

The uncertainty analysis suggests that the accuracy of the approach presented here is comparable with other methods, and it is derived mainly from theoretical model than the statistical uncertainties, defect common to the majority of methods based on I–V analysis and adopted in the current scientific and educational literature.

The advantages of the method presented here rely on the possibility to extract model parameters from data collected on a large span of I values, and to compare easily simpler models, normally adopted in undergraduate laboratories. Moreover, this analysis allows to extract a value for E_G within few per cent in accordance with the accepted one, and the method is much more simple than the spectroscopic techniques which, furthermore, are also very difficult to be applied in a laboratory course. Finally, we showed that different methods of analysis of the data bring to results which do not coincide with the expected one and are sometimes inconsistent. From an educational point of view, this is valuable as it warns the student against the pitfalls hidden in the choice of the fit procedures even with the same model and the same data.

References

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