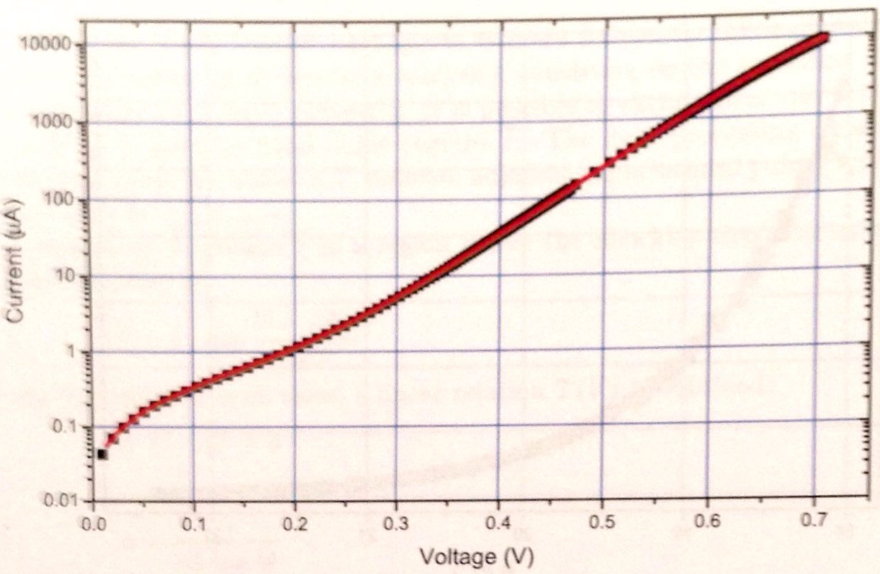

Figure 8. *I–V* data corresponding to the temperature $T = 47.8\,°C$. The line is the result of the iterative fitting procedure described in the text. The agreement is good in the full range of the currents considered with $Is = 10.5 \pm 0.2$, $B = 20.2 \pm 0.1 V^{-1}$, $R_s = 2.75 \pm 0.05\,\Omega$ and $G = 2.80 \pm 0.05\,\mu Si$.

where A depends on the geometry of the junction and the doping densities in the device.

There are two counteracting effects of an increase of n on the diode current. An increase of n causes a decrease of the current I in eq. (1) the other parameters being fixed but, on the other hand, the same increase determines an increase of I_S, at given temperature. Because of the larger value of E_G with respect to the voltage across the junction, the effect on I_S prevails and at fixed parameters, an increase of n entails an increase of I.

The need to consider the factor $1/n$ in the exponential in eq. (8) can be justified by our data, by tracing the graph of I_S as a function of temperature, as determined by the exponential fit. The result is shown in Fig. (9) where a large set of curves I–V, taken in a two hour period, are analysed. The weak power dependence on T can be neglected with respect to the exponential and the fit of the data is performed with the simplified model:

$$I_S = I_A \exp\left(-E_G B\right)$$

keeping the B parameter defined above in the place of e/nkT and expressing E_G in eV. With this position the resulting parameters are $I_A = 68 \pm 2\,A$ and $E_G = 1.117 \pm 0.002\,eV$.

Other experiments using different data processing methods on Si *p-n* junction assert a close agreement with the accepted *band-gap* value of 1.12 eV at 300 K. For example, [20] report a value of 1.13 ± 0.02 eV, operating with the base-emitter junction of a Si bipolar transistor (2N3645 model), in the temperature interval $(-75, 25)\,°C$. It is not easy to find fabrication details of the 1N4148 diode and particularly information