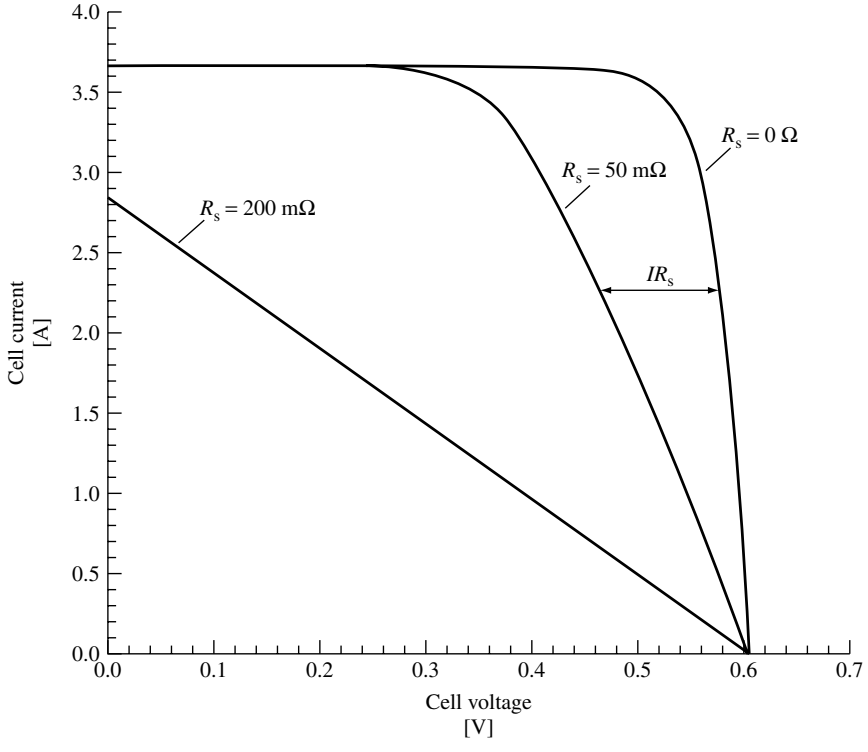

Figure 3.22 Effect of series resistance on the current–voltage characteristic of a solar cell ($R_{\text{Sh}} \to \infty$)

recombination in each region is comparable, A_o is somewhere in-between. At short circuit, equation (3.150) becomes

$$I_{\text{SC}} = I'_{\text{SC}} - I_o(\text{e}^{qI_{\text{SC}}R_{\text{S}}/A_okT} - 1) - I_{\text{SC}}R_{\text{S}}/R_{\text{Sh}} \tag{3.151}$$

and at open circuit, it becomes

$$0 = I'_{\text{SC}} - I_o(\text{e}^{V_{\text{OC}}/A_okT} - 1) - V_{\text{OC}}/R_{\text{Sh}}. \tag{3.152}$$

When $\log(I_{\text{SC}})$ is plotted versus V_{OC} (where I_{SC} and V_{OC} are obtained over a range of illumination intensities), there is typically a regime where neither the series nor shunt resistances are important, as illustrated in Figure 3.24. The slope of this line will yield the diode ideality factor A_o, while the y-intercept will give I_o. In the regime where only series resistance is important, equations (3.151) and (3.152) can be combined to give

$$I_{\text{SC}}R_{\text{S}} = \frac{A_okT}{q}\ln\left[\frac{I_o\text{e}^{qV_{\text{OC}}/A_okT} - I_{\text{SC}}}{I_o}\right] \tag{3.153}$$