DFRSOFT EXAMPLE 2 Determining the Activation Energy

The MTTFs at +250°C and +200°C are 731 and 10,400 hours, respectively, in Figure 6.8. Show that the activation energy is 1.13 eV and that the MTTF at +125°C is 1.95×10^6 hours as indicated in the figure.

SOLUTION: Equation 9.4 can be solved for E_a as

$$E_a = K_B \frac{Ln\{MTTF_2 / MTTF_1\}}{(1/T_2 - 1/T_1)} \qquad (9.6)$$

Then, the activation energy is

$$E_a = 8.6173 \times 10^{-5}\ \text{eV/°K} \frac{\text{Ln}[10400/731]}{[1/(273.16+200) - 1/(273.16+250)]\ \text{°K}} = 1.133\text{eV}$$

Next, the acceleration factor at +125°C must be determined. Using the procedure in Example 9.1, we have

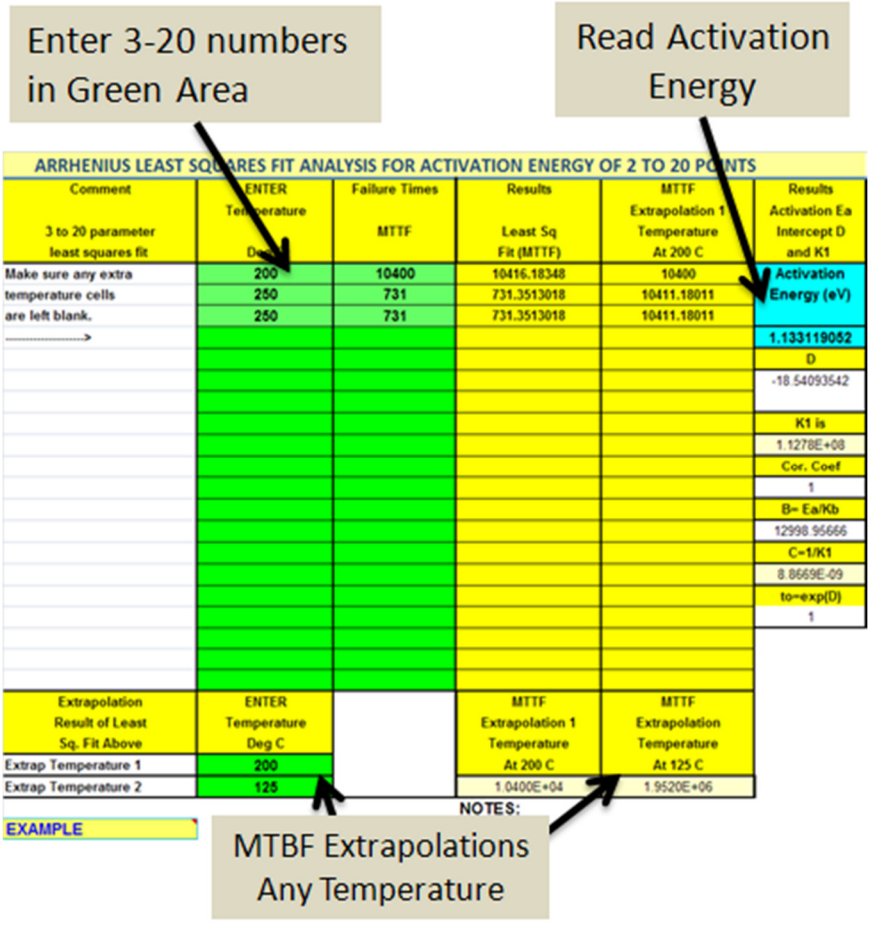
T_{use} = +125°C

T_{Stress} = +200°C

A_T = Exp {(1.133 eV/8.6171x10^{-5} eV/°K)×[1/(273.15+125) - 1/(273.15+200) °K]} = 187.6

From Equation 9.1, the MTTF (at +125°C) = MTTF (at +200°C) × A_T = 10400 × 187.7 = 1.951×10^6 hours. The answer is a bit off to the value shown in Fig. 6.8, due to round-off error.

Enter numbers in A99 Area on Acceleration Factor Work Sheet



Arrhenius Least Squares Fit to data Results Cell A133 Area on Acceleration Factor Sheet