

Grain Size Determination

4.32 (a) This problem calls for a determination of the average grain size of the specimen which microstructure is shown in Figure 4.14(b). Seven line segments were drawn across the micrograph, each of which was 60 mm long. The average number of grain boundary intersections for these lines was 8.7. Therefore, the average line length intersected is just

$$\frac{60 \text{ mm}}{8.7} = 6.9 \text{ mm}$$

Hence, the average grain diameter, d , is

$$d = \frac{\text{ave. line length intersected}}{\text{magnification}} = \frac{6.9 \text{ mm}}{100} = 6.9 \times 10^{-2} \text{ mm}$$

(b) This portion of the problem calls for us to estimate the ASTM grain size number for this same material. The average grain size number, n , is related to the number of grains per square inch, N , at a magnification of 100x according to Equation 4.16. Inasmuch as the magnification is 100x, the value of N is measured directly from the micrograph, which is approximately 12 grains. In order to solve for n in Equation 4.16, it is first necessary to take logarithms as

$$\log N = (n - 1) \log 2$$

From which n equals

$$\begin{aligned} n &= \frac{\log N}{\log 2} + 1 \\ &= \frac{\log 12}{\log 2} + 1 = 4.6 \end{aligned}$$