

13.6 This problem calls for us to compute the mass fractions of liquid for two fireclay refractory materials at 1600°C. In order to solve this problem it is necessary that we use the SiO₂-Al₂O₃ phase diagram (Figure 12.27). The mass fraction of liquid, W_L , as determined using the lever rule and tie line at 1600°C, is just

$$W_L = \frac{C_{\text{mullite}} - C_0}{C_{\text{mullite}} - C_L}$$

where $C_{\text{mullite}} = 72$ wt% Al₂O₃ and $C_L = 8$ wt% Al₂O₃, as determined using the tie-line; also, C_0 is the composition (in weight percent Al₂O₃) of the refractory material.

(a) For the 25 wt% Al₂O₃-75 wt% SiO₂ composition, $C_0 = 25$ wt% Al₂O₃, and

$$W_L = \frac{72 - 25}{72 - 8} = 0.73$$

(b) For the 45 wt% Al₂O₃-55 wt% SiO₂ composition, $C_0 = 45$ wt% Al₂O₃, and

$$W_L = \frac{72 - 45}{72 - 8} = 0.42$$