

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 $\text{SiO}_2\text{-Al}_2\text{O}_3$ 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 $C_{\text{mullite}} = 72 \text{ wt\% Al}_2\text{O}_3$ and $C_L = 8 \text{ wt\% Al}_2\text{O}_3$, as determined using the tie-line; also, C_0 is the composition (in weight percent Al_2O_3) of the refractory material.

(a) For the 25 wt% Al_2O_3 -75 wt% SiO_2 composition, $C_0 = 25 \text{ wt\% Al}_2\text{O}_3$, and

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

(b) For the 45 wt% Al_2O_3 -55 wt% SiO_2 composition, $C_0 = 45 \text{ wt\% Al}_2\text{O}_3$, and

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