

Expression for Reverse Boudouard Reaction in a Mixed Flow Reactor

$$(F_{A0}/W) \dot{f} = k_f K_{eq_{for}} \theta_b(\dot{f}) - k_f \theta_f(\dot{f})$$

[Eqn 4]

This equation solved simultaneously with Equation 2 will provide the two unknowns sought.

The equilibrium fractional conversion, \dot{f}^{eq}_A , can be obtained from the given equilibrium expression,

$$\ln(K_{eq_{for}}) = 21042/T + 5.16E-04 \cdot T - 22.088$$

Calculated \dot{f}^{eq}_A values are shown in Table 2.1 below.

Equation 4 is a simplification because it does not account for the change of mass as the reaction progresses. This loss of mass could be expressed as,

$$dW_C/dt = -a \, 8 \, \pi \, \rho_C \, \Delta R \, R_{sh} \, ,$$

[Eqn 5]

where

a the rate of change of carbon particle radius

Table 2.1 Reaction Data for Boudouard Reaction

Characteristic	Forward	Reverse
Initial Conditions	$F_{A0} = 0.5, F_{B0} = 0, F_{C0} = 0$ $T = 900 \text{ C}$	$F_{A0} = 0.5, F_{B0} = 0.6, F_{C0} = 0$ $T = 900 \text{ C}$
Equilibrium Fractional Conversion, \dot{f}^{eq}_A	0.2535	0.80797