**Shrinking-Core Model to describe fluid-solid interactions**

Three resistances:

1. Film layer (bulk phase): assume transport across film layer is dominant
2. Ash phase: assume transport through reacted ash phase is dominant
3. Core phase: assume reaction in core is dominant

ፀ = t/τ

XB = reacted/initial solid = 1 - (rC/R)3

XB(t), CAg, ρB, R

Derive model for time (t) required for reaction front to move to position X

vAA(l)+vBB(s) --> P

Surface area plays a role because -1/s dNA/dt = k(CAg - 0)

NB = ρB \* V

Nomenclature: b = vB/vA

See table 25.1: conversion-time expressions

Noodles are current product:

Takes 15 minutes to hydrate in boiling water

Ρstarch = 0.3 mol/cm3

R = 0.5 cm, cylinder

CW = 0.5555 mol/cm3 (water)

7.5 mol water to hydrate 1 mol starch

7.5 W + 1 S --> P

Hydration reaction is hydration reaction controlled mechanism

1. Instant lasagna noodles (flat plates) -- thickness = 0.5 cm
2. Noodle balls -- R = 2cm

Flat plate: τ = ΡstarchL/bk’’CAg

Ball: τ = ΡstarchR/bk’’CAg

Flat plate: 0.3 mol/cm3 \* 0.25 cm / 1/7.5 \* k \* 0.5555 = 15 min

In actuality: no ash phase -- shrinking particle model! Model simplified into 2 -- film layer and core reaction control

Reaction:

Film: STOKES

Reynold’s Number: Re