Study hard, play harder

Heterogeneous system vs. homogeneous system:

* Homogeneous: one phase that the reaction occurs in, reaction rate r = mass/volume\*time
* Heterogeneous: multiple phases interacting, need to know geometries, diffusion, reaction rate r = mass/surface area\*time

C units: mass/volume

**First Order:**

-r = kC

K = 1/time (homogeneous)

K = length/time (heterogeneous

Shrinking core model



No ash phase, just film and core (film and reaction resistances) ==> CAs = CAc

Film: important parameters are fluid behavior and geometry

Second order reactions... how are conversion-time expressions for various shapes of particles, shrinking core model changed

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| SECOND ORDER | Film | Ash | Reaction |
| Flat Plate | t/τ = XB  τ = ρBL/bkgCAg | t/τ = XB2  τ = ρBL2/2bkgDeCAg | t/τ = XB  τ = ρBL/bkCAg2 |
| Cylinder | t/τ = XB  τ = ρBR/bkgCAg | t/τ = XB+(1-XB)ln(1-XB)  τ = ρBR2/4bkgDeCAg | t/τ = 1 - (1-XB)1/2  τ = ρBR/bkCAg2 |
| Sphere | t/τ = XB  τ = ρBR/bkgCAg | t/τ = 1-3(1-XB)2/3+2(1-XB)  τ = ρBR2/6bkgDeCAg | t/τ = 1 - (1-XB)1/3  τ = ρBR/bkCAg2 |

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| --- | --- | --- | --- |
| NTH ORDER | Film | Ash | Reaction |
| Flat Plate | t/τ = XB  τ = ρBL/bkgCAg | t/τ = XB2  τ = ρBL2/2bkgDeCAg | t/τ = XB  τ = ρBL(Km+Cag)/bVmCAg |
| Cylinder | t/τ = XB  τ = ρBR/bkgCAg | t/τ = XB+(1-XB)ln(1-XB)  τ = ρBR2/4bkgDeCAg | t/τ = 1 - (1-XB)1/2  τ = ρBR(Km+Cag)/bVmCAg |
| Sphere | t/τ = XB  τ = ρBR/bkgCAg | t/τ = 1-3(1-XB)2/3+2(1-XB)  τ = ρBR2/6bkgDeCAg | t/τ = 1 - (1-XB)1/3  τ = ρBR(Km+Cag)/bVmCAg |

3 O2 + 1 Oil --> products

Cylindrical (r = 1cm)

1. Air 21% mol oxygen
2. Pure oxygen

τ = ρBR2/4bDeCAg