

South Dakota School of Mines and Technology
Department of Materials and Metallurgical Engineering

Met 426/526

Homework 03

1. Write a ODE model describing the reduction of NiO to Ni using H_2 gas and solve it using MathCad. The model should compute
 - the mole fraction of Ni in the pellet (X),
 - the mole fraction of H_2 (Y) in the countercurrent flowing reducing gas,
 - the temperature of the gas T_g , and
 - the temperature of the solid T_s .

Assume

- the molar density of the pellet (i.e. - constant pellet radius),
- an overall kinetic term k (i.e. - total resistance = $1/k$),
- the same heat capacities for both Ni and NiO and for H_2 and H_2O .
- A constant heat of reaction.

Use the model to find the length of reactor needed to achieve 99.9 percent reduction of the NiO.