

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<sub>2</sub> gas and solve it using MathCad. The model should compute
  - the mole fraction of Ni in the pellet (X),
  - the mole fraction of H<sub>2</sub> (Y) in the countercurrent flowing reducing gas,
  - the temperature of the gas T<sub>g</sub>, and
  - the temperature of the solid T<sub>s</sub>.

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<sub>2</sub> and H<sub>2</sub>O.
- A constant heat of reaction.

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