A Model of a Horizontal Atmospheric Pressure Chemical Vapor Deposition Reactor

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Introduction

A model of a horizontal atmospheric pressure chemical vapor deposition reactor was implemented to aid in the design of a laboratory based chemical vapor deposition reactor. The model coupled momentum transport, energy transport, and mass transport phenomena to account for reacting fluid flow of a compressible gas in a heated chamber. The system modeled was silicon deposition from trichlorosilane in hydrogen carrier gas.

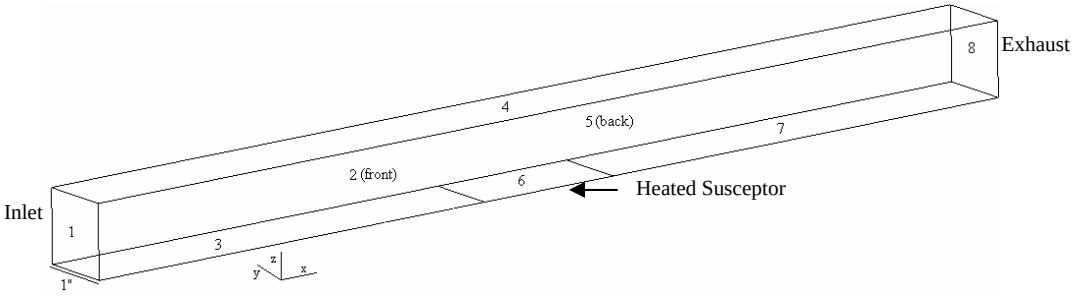

Figure 1: Reactor schematic

Results

A parametric study was performed using a two-dimensional model to investigate the sensitivity of the model's predictions for growth rate and uniformity of the deposited silicon film to changes in inlet Reynolds number, susceptor temperature, and feed mole fraction of trichlorosilane. Figure 2 is a contour plot of the sensitivity of growth rate to changes in inlet Reynolds number and susceptor temperature.

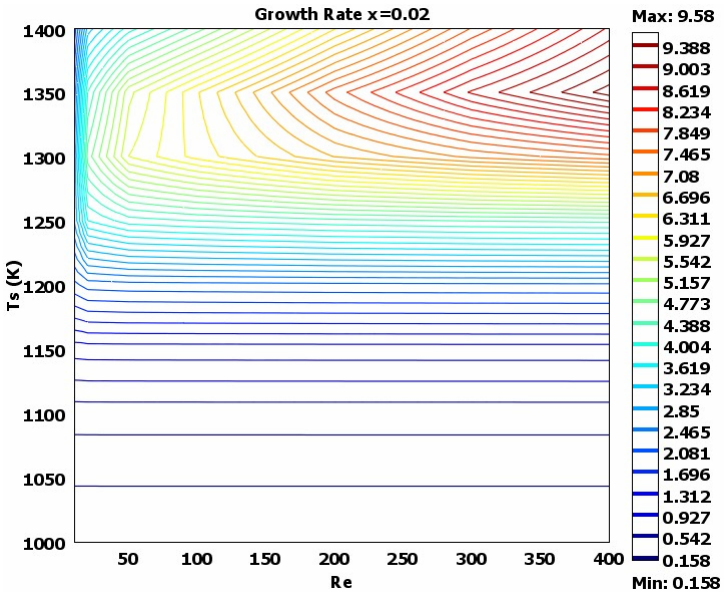

Figure 2: Contour plot of growth rate vs. Reynolds number and susceptor temperature

A three-dimensional model of the reactor was implemented to determine the effects of the reactor walls on growth rate and uniformity. The results of the two-dimensional model and three-dimensional model were compared and showed good agreement for the predictions of growth rate with a disparity of less than 0.75% between the two models.

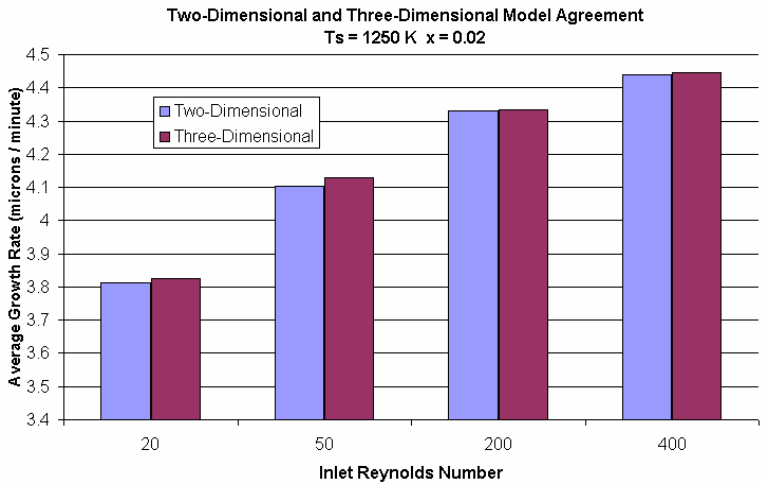

Figure 3: Agreement of two-dimensional and three-dimensional models, varied N_{Re}