3D Modeling and Optimization of SiC Deposition from CH3SiCl3/H2 in a Commercial Hot Wall Reactor

Balamurugan Deivendran[1], Vijay Shinde[1], Harish Kumar[2], and N Eswara Prasad[2]

[1]Indian Institute of Technology BHU Varanasi
[2]DRDO Defence Materials and Stores Research and Development Establishment

June 16, 2020

Abstract

In this paper, the 3D modeling and optimization of a commercial hot wall vertical reactor for SiC coating is presented to investigate the effect of various process parameters on the hydrodynamics stability of the CVD reactor. The correlation between experimental and simulated results was established by tuning the kinetic parameters for the surface reaction. Besides, the incorporation of various dimensional numbers such as Reynolds number (Re), Péclet number (Pe), and Grashof number (Gr) enabled the systematic investigation of the effect of the natural convection phenomena on film growth performance. It was found that the buoyancy-driven flow can occur inside the reactor at high Reynolds number and Gr/Re2 ratio. The process optimization was performed using response surface methodology (RSM) to obtained desired film quality. The CFD-RSM combined approach allowed a significant reduction in the number of experiments and simulations required for the optimization of the CVD process.

Hosted file

`Manuscript.doc` available at https://authorea.com/users/334098/articles/460166-3d-modeling-and-optimization-of-sic-deposition-from-ch3sicl3-h2-in-a-commercial-hot-wall-reactor