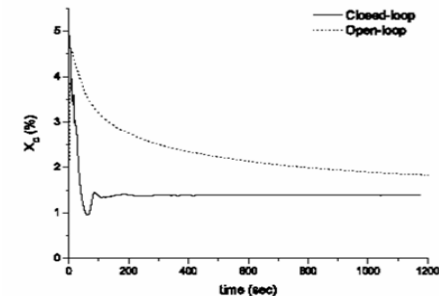
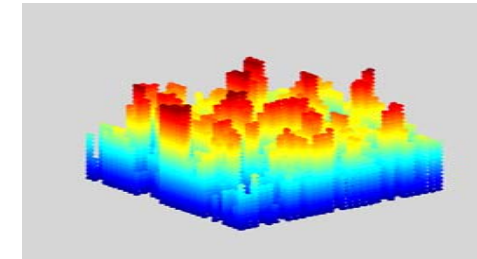
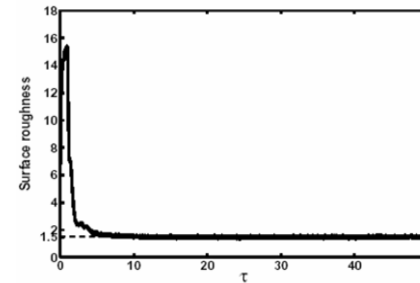


## Goals and Potential Impact if Successful

- Achievement of desired material microstructure and composition
- Implementation on detailed process models and experimental thin film growth processes.
- Development of novel feedback control methods by integrating multiscale distributed models and on-line measurement techniques
- Meet the increasingly stringent requirements on quality of semiconductor thin film from electronic chip industry.



## Approach and/or Accomplishments

- \*Multiscale Modeling:
  - Continuous PDE models for gas phase dynamics.
  - Stochastic models for thin film microstructure
- \*Real-Time Estimation:
  - Model reduction.
  - Correlation of real-time gas phase measurements to thin film composition and microstructure.
- \*Feedback Control Design:
  - Estimator/Controller structure.
  - Spatially distributed sensing and actuation.

## Bottlenecks and Open Research Questions

- \*Using stochastic multiscale models for controller design.
  - Methods for feedback controller design based on Monte-Carlo models.
  - Systematic model reduction techniques for stochastic PDE models.
  - Feedback controller design based on stochastic PDE models.
- \*Computational efficiency of simulators.
  - Possibility of implementation of Monte-Carlo simulation in multiple CPUs.