Eidgenössische
Technische Hochschule
Zürich

Ecole polytechnique fédérale de Zurich
Politecnico federale svizzero di Zurigo
Swiss Federal Institute of Technology Zurich

Institut für Verfahrenstechnik ***Sommersemester 2001***
Prof. S.E. Pratsinis, pratsinis@ivuk.mavt.ethz.ch

Seminars in Process Engineering
Kolloquium Technische Wissenschaften

Dienstags 16.15h - 17.15h; Raum ML F 38, Sonneggstrasse 3, CH-8092 Zürich

April 3	"Emission Control Applications of Vanadia/Titania-based Catalysts" Prof. Michael Amiridis (Host: Prof. Alfons Baiker, D-CHEM, ETHZ) Chemical Eng'g Dept., Univ. of South Carolina, Columbia, SC, USA
April 10	"Evaporation of Heavy Metals in Thermal Processes" Dr. Christian Ludwig, Head, Group of Chemical Processes and Materials Paul Scherrer Institut (PSI), General Energy Research Department, Villigen
April 24	"Aerosol particles for electronic devices" (ERCOFTAC Lecture) Dr. Knut Deppert, Dept. of Physics, University of Lund, Sweden
May 8	"Polymeric Nanocomposites" Prof. Ulrich W. Suter, Department of Materials, ETH Zürich
May 15	"Nanoparticle Chain Aggregates: Building Blocks for Elastic Materials" Dr. Sheldon K. Friedlander, Parsons Professor Chemical Engineering, UCLA, Los Angeles, CA, USA (ERCOFTAC Lecture)
May 22	"Plasma Synthesis of Nanoparticles and their Properties" Prof. Dieter Vollath, Forschungszentrum Karlsruhe, Germany
May 29	"Diamond Film Growth from Hydrocarbon Combustion" Prof. Phil Morrison, Dept. of Chemical Engineering, Case Western Reserve University, Cleveland, OH, USA
June 5	"Mass Transfer Characteristics of a Novel Gas-Liquid-Contactor, the Advanced Buss-Loop-Reactor" Frank Baier (advisors: Prof. F. Widmer and Prof. P. Rudolf von Rohr) Institute of Process Engineering, ETH Zürich
June 12	"Kinetics of particle formation in flames and shock wave reactors" Prof. Paul Roth, University of Duisburg, Germany
June 15, **Friday** **ML H 43, 16.00**	"MOCVD of Compound Semiconductors" Prof. Tim Anderson, Chairman of Dept. of Chemical Engineering, University of Florida, Gainesville, FL, USA
June 19	"Nanopartikel Charakterisierung" (tentative) (Vorlesung auf Deutsch) Prof. Reinhard Polke, BASF AG, Ludwigshafen, Germany
June 26	"Polymer Quality Control in a Polymerization Reactor Using On-line Measurement Data and Nonlinear Model Predictive Control" Prof. Hyun-Ku Rhee (Host: Prof. M. Mazzotti) Dept. of Chemical Engineering, Seoul National University, Korea
July 3	"Structure of unsupported nanoparticles by electron diffraction in supersonic jets and High Resolution Transmission Electron Microscopy" Prof. Philippe Buffat Centre Interdepartemental de Microscopie Electronique, EPF Lausanne

Vor Beginn des Seminars (16.00 Uhr) werden Gebäck und Getränke serviert.
Bitte beachten Sie unsere Web-Seite http://www.ivuk.ethz.ch/events *für allfällige Änderungen.*

ABSTRACT (150601)

MOCVD of Compound Semiconductors

Prof. Tim Anderson
Chemical Engineering Department
University of Florida

Compound semiconductors and their solid solutions are receiving intense investigation, primarily because of the existence of degrees of property freedom and the promise of improved electronic and optoelectronic devices. Epitaxial deposition of thin films of compound semiconductors is a critical step in the fabrication of solid-state devices. These films are most commonly deposited by chemical vapor deposition. This presentation addresses a few research issues encountered in designing this gas-solid reactor.

The requirements of a film deposition process include the growth of films uniform in composition and thickness, the formation of abrupt interfaces, the specification of lateral dimensions, the control of background and intentional doping levels, the elimination of extended defects, and the deposition of smooth surfaces. Several examples will be given to illustrate techniques to meet these stringent requirements. In particular, results on the influence of growth interruption and temperature on the abruptness of MOCVD GaInP/GaAs interfaces will be presented. In a related area, recent studies on the MOCVD selective area growth of GaInAsP on InP indicate a nonlinear growth rate enhancement and composition modulation. These examples, as well as others, will be presented to illustrate the use of the chemical engineering sciences to increase our understanding of issues relevant to epitaxy.

ABSTRACT (190601)

Nanopartikel Charakterisierung

Professor Reinhard Polke
BASF AG, Ludwigschafen, Germany

In product and process design particle system characterisation as well as modelling are important tools to understand processes and product behavior. Recent experiences show that there is a very stimulating reciprocal dependency of both activities on each other.

In a first step we realized that in solids processes like comminution many product and equipment properties have to be gathered by experiments. We employed off-line and on-line characterisation methods and developed preparation techniques for the samples.

In a second step we tested comminution models from literature, and found that we could achieve reasonable, but not fully satisfying agreement. Our conclusions were that we would have to improve both our models and our characterisation techniques. We have already discussed these findings in former papers. Presently, the on-line methods are well suited for process control and to detect transient behaviour. Their precision is not sufficient for the required depth of information, so that lab methods have to be employed as well.

In this presentation, we want to point out that this process is something like an iteration consisting of several steps. The modelling capabilities we achieved are a very effective instrument to test the validity of our characterisation methods and to assess the effect of our preparation methods.

We have to consider three categories of models:

- a model which describes the dependence of product quality on the disperse state and behavior
- a model which describes the process conditions leading to the disperse state and
- a model which describes the physical measuring effect in a complex particle system.

These models are very closely related. We carry out measurements to understand the product bahavior and the process, but we must understand the product behavior and the process in order to carry out the measurements correctly. We will discuss this concept with some examples, taken from dry and wet grinding.

ABSTRACT (260601)

Polymer Quality Control in a Polymerization Reactor Using On-line Measurement and Nonlinear Model Predictive Control

Prof. Hyun-Ku Rhee
Dept. of Chemical Engineering
Seoul National University, Seoul, Korea

The seminar will start with a discussion on the on-line measurement of polymer quality including the equipments, the correlations needed, and the comparison of the on-line measurement with the off-line measurement

It then continues to introduce the extended Kalman filter (EKF) based nonlinear model predictive control (NLMPC) and apply this control algorithm with the first principles model to a continuous reactor for the solution polymerization of methylmethacrylate. Here both the monomer conversion and the weight average molecular weight are to be controlled by manipulating the monomer feed rate and the jacket inlet temperature. Experimental results of the set-point tracking control will be presented not only for a SISO system but also for a MIMO system.

Next, we proceed to use the polynomial ARMA model for the identification of a continuous reactor for the solution polymerization of styrene. Instead of using the first principles model, the identified model is employed to design an ARMA model based NLMPC for its application to the polystyrene reactor. Here again, the objective is to control the monomer conversion and the weight average molecular weight by manipulating the monomer feed rate and the jacket inlet temperature. The results of simulation study as well as experimental work will be discussed with respect to the set-point tracking control for a MIMO system.