Functional Hyperbranched Polyesters for Application in Coatings and Thin Films

Voit, B.; Beyerlein, D.; Eichhorn, K.; Grundke, K.; Schmaljohann, D.; Loontjens, J.A.

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The Phenomenon of "Biological Resonance" – Basis for Optimization of Biological Treatment Units

Schmid A.

Sc.-Engineering, Umweltverfahrenstechnik & Biotechnologie, Oedschoenlind 8, 95703 Ploessberg, Germany, Dr.A.Schmid@Sc-Engineering.de

Physical resonance effects occur when an external attractor stimulates the system with its natural frequency. The start-up of protein synthesis is accompanied with oscillations and might also lead to a resonance case when stressing the microorganisms with the "natural frequency" of the protein synthesis machinery.

In this study, we show the theoretical background for describing the phenomenon of "biological resonance" and the related experimental results where a permanent elevated inducible enzyme synthesis-rate of microorganisms up to 60% was observed by periodic variations of external process parameters in a minutes interval.

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Vanishing Process of the Liquid Phase in Presence of an Exothermic Multiphase Reaction

Z. M. Cheng
J. H. Zhong
A. M. Anter
J. S. Hu
Q. Xiao
W. K. Yuan

State Key Laboratory of Chemical Reaction Engineering, East China University of Science and Technology, 200237 Shanghai, P. R. China, (Email: zmcheng@public4.sta.net.cn; wkyuan@ecust.edu.cn)

For exothermic reaction systems with substantial volatility, the liquid components can vaporize entirely through absorption of the reaction heat. According to the energy analysis, the length of the liquid region should be exclusively determined by the conversion in this region if the liquid vanishing temperature is equal to that of the reactor. Chemical and physical contributions are believed to account for the overall vaporization under different effects. Based on the observation of the isothermal feature of the liquid region, discussions were made on the length of the liquid region and the reaction rate. A three-stage phenomenalogical reactor model was supposed to describe the phase transition along the reactor.

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Reactor Concepts for High Throughput Testing

Stuart Thomson
Christian Hoffmann
Thorsten Johann
Anke Wolf
Hans-W. Schmidt
David Farrusseng
Ferdi Schüth

Max Planck Institut für Kohlenforschung, Kaiser Wilhelm Platz 1, Mülheim an der Ruhr, Germany

The development of high throughput methods for the discovery of heterogeneous catalysts has been applied to both fixed bed and three phase catalytic systems, with an emphasis on conducting all experiments under identical or very similar conditions as found in conventional catalytic reactors. For fixed bed reactor testing at standard pressure, several multi-pass reactors, capable of holding 16 and 49 samples, respectively, have been designed. For three phase catalytic reactions, a vessel has been constructed with the capability of simultaneously reacting 25 samples at a maximum pressure of 50 bar and a temperature limit of 373 K. In this article we will describe our recent endeavours in designing such reactors and describe initial catalytic data obtained.

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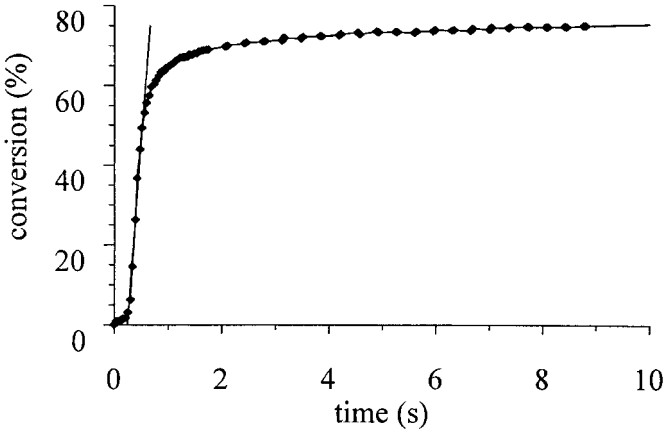
B. Voit[1]*
D. Beyerlein[1]
K. Eichhorn[1]
K. Grundke[1]
D. Schmaljohann[1]
J.A. Loontjens[2]

[1]Institute of Polymer Research Dresden, Hohe Strasse 6, 01069 Dresden, Germany

[2] DSM Research, 6160 MD Geleen, The Netherlands

A variety of fully aromatic, mixed aromatic-aliphatic, and pure aliphatic hyperbranched polyester with different functional groups have been prepared. For an application in UV curable coatings a hyperbranched polyester based on 4,4-bis(4'-hydroxyphenyl) pentanoic acid was modified with vinyl ether groups. Fast and efficient curing could be obtained using a cationic photoinitiator and a reactive diluent. From fully aromatic hyperbranched polyesters having hydroxyl, carboxyl and acetoxy end groups thin isotropic layers with a smooth surface could be prepared. The surface properties were characterized carefully by different methods. First experiments with exposition of these layers to different atmospheric humidities showed a controlled swelling and/or adsorption/desorption behavior in dependence on the functional groups. Further investigations are done to demonstrate the sensoric potential.

Figure.
Conversion of vinyl ether groups in the coating versus UV-irradiation as monitored by rapid scan in-line FT-IR spectroscopy (P1-O-BVE/triethylene glycol divinylether 1:1, 2 % UV initiator).



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Technical Features of Ceramic Foam Catalyst Carriers in Relation to their Manufacture

F. C. Buciuman
B. Kraushaar-Czarnetzki
Institute of Chemical Process Engineering CVT, University of Karlsruhe, Germany

The properties of ceramic foam monoliths meant to be used as catalyst carriers can be controlled during manufacture by the appropriate choice of the ceramic slip composition. A key factor is the viscosity of the ceramic slip used to coat the polymeric sponges, which have to be correlated with the pore size of the sponges. Depending on the slip viscosity, the sponge struts become more or less coated with the ceramic precursor, yielding finally ceramic struts of different thickness. Accordingly, ceramic foams having thicker struts posses higher mechanical strength but produce more pressure drop by fluids flowing through. The foam properties can be optimized according to the envisaged application.

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New Applications of Fluidised Bed Granulation

Dr.-Ing. Stefan SCHULZE
Christian ALT
Dr.-Ing. Claas-Jürgen KLASEN
Degussa AG, Process Technology & Engineering, Hanau, Germany

Fluidised bed spray granulation is an established process for producing bulk materials with exceptional characteristics. Until now, fluidised bed granulation processes have predominantly been used for drying solutions and suspensions based on water. Air has primarily been used as the heat transfer media and fluidising gas. The prominent product characteristics makes it desirable to apply fluidised bed spray granulation to products in other solvents or when any oxygen within the hot gas would damage the product. Furthermore it is also possible to expand the process by integrating other processing steps besides drying and shaping into the procedure. For example, reactions to form the desired solid can also be integrated into the fluidised bed by feeding in different fluid flows. Circulating fluidised beds make it possible to generate solids that cannot form a stationary bed because of their density and particle size.

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Generation of Micron Sized Particles by Direct Contact Cooling A Parameter Study

Thomas Schleiden
Hans Offermann
Thomas Melin
Department of Chemical Engineering, University of Technology Aachen, Turmstr. 46, 52056 Aachen, Germany

The generation of submicron sized particles by direct contact cooling (**DCC**) is investigated in a parameter study from a theoretical point of view. The goal of this work is to estimate resulting particle sizes as a function of the kinetic and the cooling rate. Therefore the crystallization of a model substance in a homogeneously cooled droplet is considered. The kinetic of nucleation is described by the "classic" theory of homogeneous nucleation, whereas the kinetic of crystal growth is assumed to be diffusion controlled. Calculations are done for different mass transfer coefficients, maximum nucleation rates and time dependent changes of the solubility. Consideration of the gradients of the solubility function and cooling rates, which are attained by **DCC,** enables an estimation of required gradients of the solubility line. The results demonstrate the need of very high cooling rates in order to produce (sub-) micron sized particles.

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Determination of Drying Kinetics of Viscous, Shrinking Products

Dr.-Ing. Marc Räderer[1]
Dr. Alain Besson[1]
Prof. Dr.-Ing. Karl Sommer[2]
1. Nestlé Product Technology Centre Orbe, 1350 Orbe, Switzerland
2. Lehrstuhl für Maschinen- und Apparatekunde, TU München-Weihenstephan, 85350 Freising, Germany

A thin film dryer device (TFD) and an acoustic levitator has been used to study the drying behavior of viscous products. The thin