CHEMISTRY & SUSTAINABILITY

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ENERGY & MATERIALS

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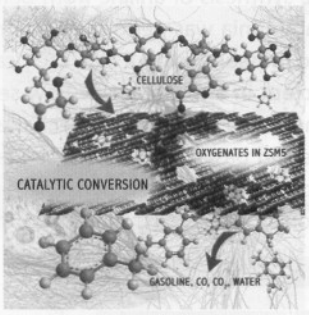
COVER PICTURE

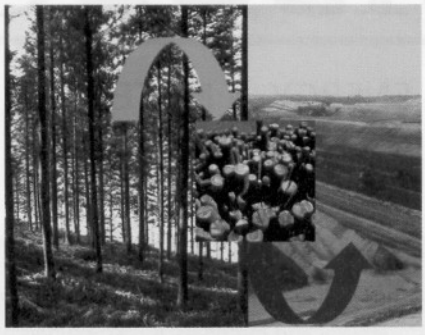


The cover picture shows a scheme for the conversion of cellulose into gasoline-range aromatics by catalytic fast pyrolysis. Owing to its recalcitrance, there are currently no economical processes for the direct conversion of lignocellulosic biomass into useful chemicals and fuels. G. W. Huber et al. report in the Communication on page 397 ff. a process that they have developed which involves the thermal decomposition of cellulose to smaller volatile oxygenates as the first step. These biomass-derived species then enter the pores of the zeolite catalyst ZSM5, where they undergo a series of dehydration, decarbonylation, decarboxylation, isomerization, oligomerization, and dehydrogenation reactions that lead to aromatics, including naphthalene, ethylbenzene, toluene, and benzene, and by-products such as carbon monoxide, carbon dioxide, and water. All this takes place at short residence times (less than 2 min) at 600 °C in a single reactor.

NEWS

ESSAY

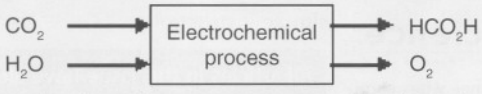
F. Scholz, U. Hasse*



Seeing the woods for the trees: The global CO_2 problem can only be solved by the introduction of a permanent carbon sink based on the use of natural photosynthesis. In the "wood growth and burial process", humans produce biomass, especially wood, for it to be later removed from the global carbon cycle by burial under anaerobic conditions (e.g. on the bottom of emptied open pits). Moreover, the buried wood is a deposited good and potentially available for future use.

CONCEPT

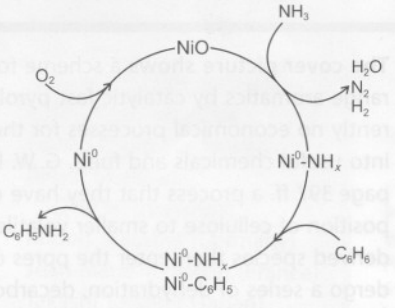
C. Oloman, H. Li*



Decreasing CO_2 by reduction: Electroreduction is an option for the conversion of CO_2 into useful chemicals. Experimental data from a 100-A continuous reactor have been extrapolated to the conceptual design of processes for the conversion of CO_2 into formate/formic acid on a commercial scale. The costs and return on investment for a range of values of the carbon credit accrued to such an operation have also been estimated.

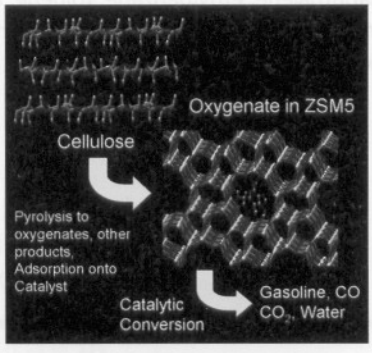
COMMUNICATIONS

*N. Hoffmann, E. Löffler, N. A. Breuer, M. Muhler**



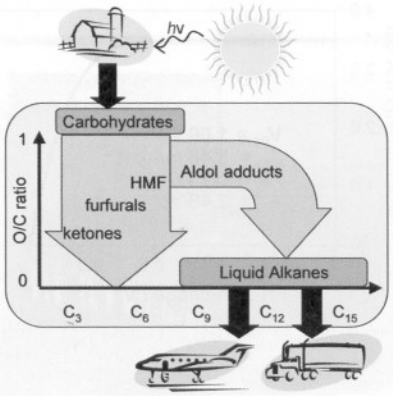
Suspended amination: Semi-batch oxidative synthesis of aniline from benzene and ammonia was performed at atmospheric pressure using a NiO/ZrO_2 cataloreactant in a microreactor flow setup. A Langmuir–Hinshelwood mechanism is suggested based on the surface reaction between adsorbed benzene- and ammonia-derived NH_x species on metallic Ni surface sites.

*T. R. Carlson, T. P. Vispute, G. W. Huber**

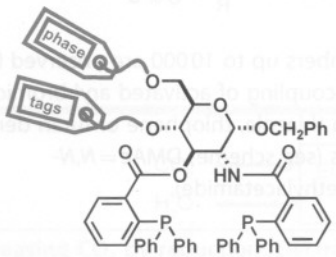


A fuelling success: High-quality aromatic fuel additives can be produced directly from solid biomass feedstocks by catalytic fast pyrolysis in a single catalytic reactor at short residence times. High heating rates and catalyst-to-feed ratios are needed to ensure that pyrolized biomass compounds enter the pores of the ZSM5 catalyst and that thermal decomposition is avoided. Product selectivity is a function of the active site and pore structure of the catalyst.

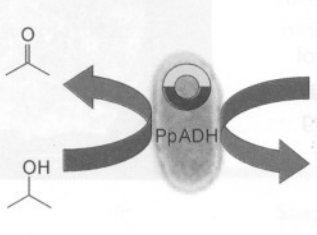
FULL PAPERS



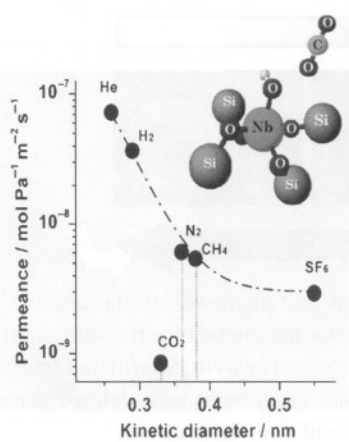
Right on target: Transportation fuels can be directly produced from renewable biomass resources by converting carbohydrates into alkanes with targeted molecular weights, such as C_8–C_{15} for jet-fuel applications. Targeted alkanes can be produced from a variety of biomass-derived carbonyl compounds, such as fructose, 5-hydroxymethylfurfural, 5-methylfurfural, 2-furaldehyde, and acetone.



A sweet privilege: Aimed at combining the high chemical performance of asymmetric catalysis with the increasing need of sustainability, Trost-like ligands were prepared that contain both coordinating functions and phase tags on a D-glucose scaffold. The ligands were then applied with Pd in multiphasic homogeneous catalysis with promising results.



Suffering sulfur gladly: A novel short-chain alcohol dehydrogenase from *Paracoccus pantotrophus* (PpADH) has been identified and overexpressed in *E. coli* and then used to stereoselectively reduce ketones. The enzyme displays an excellent tolerance towards dimethyl sulfoxide (DMSO), with high conversions observed in the presence of 50% v/v DMSO.



Stayin' in the membrane: A microporous composite membrane composed of niobia and silica shows an exceptionally low permeability for carbon dioxide despite its small size. Other small molecules such as hydrogen, methane, oxygen, and nitrogen can pass much more easily. Nb-bound hydroxy groups probably act as strong adsorption sites for carbon dioxide. Such a gas-selective ceramic membrane may be useful to separate CO_2 from gas mixtures.

CONTENTS

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* Author to whom correspondence should be addressed.

INTERVIEW

BOOKS

SERVICE

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