Carbon dioxide from the flue gas - waste or chemical raw material?

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Slovakia belongs in the group of twenty worst polluters throughout the world, releasing 10 - 12 tons of carbon dioxide per capita, whereas the world-wide average value is about 5 tons. It is known that the share of big electric and thermal power stations is only 25 % in the overall production of carbon dioxide in Slovakia, whereas the biggest producer of carbon dioxide is the industry by 31%. The aim of the present contribution is to show possibilities of further chemical conversion of the separated carbon dioxide from flue gas as chemical raw material. Of large-scale productions, we focused our attention to the feasibility of the conversion of carbon dioxide into carbon oxide or synthesis gas and its further conversion into methanol. The production of synthesis gas from carbon dioxide, coke (coal) and natural gas was assumed. On the basis of our studies and their conclusions we can claim that the fulfilment of the national target of the Slovak Republic set up for 2005, i.e., the reduction of carbon dioxide emissions by 20 % against 1988 by chemical transformation of carbon dioxide from the flue gas from electric power stations is not realistic. In our opinion a profound reduction of carbon dioxide emission can be reached by lower demands for energy produced by burning fossil fuels or by the substitution of these fuels by alternative energy sources.

Key words: flue gas, carbon dioxide, waste, raw material, energetic costs, synthesis gas, methanol, urea

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FCC Gasoline Desulfurization Options

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Environmental forces in both the United States and Europe are driving refiners to produce gasoline with lower and lower sulfur content. To meet these requirements, refiners in the future may have to produce a fluid catalytic cracking (FCC) gasoline with =100 ppm sulfur. Refiners currently have a variety of process option to choose from. Of these, feed hydrotreating is only option that can provide a positive return on investment, but because the investment required is quite large, many refiners are forced to look elsewhere.

Desulfurizing FCC gasoline is much less capital intensive, and many process options to accomplish that objective are available. These options include:

Undercutting the FCC gasoline

Hydrotreating the full-range FCC gasoline

Hydrotreating the heavy FCC gasoline fractions

Using the extractive MEROX process to treat the light FCC gasoline

Using liquid-liquid extraction to remove sulfur compounds from the heavy FCC gasoline

Recracking the heavy FCC gasoline

Selectively hydrotreating with the ISAL process.

Each of these process options have its own unique advantages and disadvantages that have to be accessed to determine the option that best fits a particular refinery situation. A process for the adsorption of the sulfur compounds from FCC gasoline is currently under development. If the development is successful, the adsorption process could be most interesting of all the gasoline desulfurization options.

Key words: FCC, desulfurization, hydrotreating, gasoline, undercutting, extractive Merox, ISAL

Hydrotreating of Propane and Butane Deasphalted Oils

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The utilization of deasphalting processes in one of the possibilities for deeper treatment of crude oil residues. By the selection of convenient hydrotreating of the deasphaltization rafinate - deasphalted oil (DAO) - it is possible to obtain final products or by-products for sequent processes. The hydrodesulphurization (4 MPa), mild hydrocracking (7 MPa) and hydrocracking (15 MPa) of the propane and butane deasphalted oils were studied. The commercial Ni-W catalyst on aluminosilicate was used and experiments were carried out on experimental throughflow reactor with fixed bed of catalyst. The products of the hydrotreating of propane and butane deasphalted oils were from the view of their utilizations as components of diesel fuels, low-sulfur heating oils or as feedstocks for catalytic reforming, FCC or steam cracking and lube oils production.

Key words: deasphalting oil, C4-DAO, C3-DAO, Ni-W hydrocracking catalyst, hydrotreating, hydrodesulphurization, mild hydrocracking, hydrocracking, hydrocracking, motor fuels, FCC feedstock

NEW TYPE OF LUBRICANT ADDITIVES FOR PROTECTING THE ENGINES AND THE ENVIRONMENT

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The new type of lubricant additive results in reductions of wear, friction, fuel consumption, oil consumption, harmful emission and restores the cylinder compressions. It is pure organic compound, free of environmental poisoning components as metals, phosphorus, sulfur and halogens. It has multifunctional character as friction modifier, anti-wear, anti-oxidant, rust inhibitor and extreme pressure (EP).

Key words: new type of additive, multifunctional character, free of environmental poisoning components, protects the environment.

A New Generation of Ashless Antioxidants

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The performance of a new liquid ashless mixed primary/secondary antioxidant AO-64 is compared against two primary liquid ashless antioxidants DPA-57 (aminic type) and AO-135 (sterically hindered phenol). The additive DPA-57 is produced locally in Slovakia by Duslo, a.s. AO-64 shows excellent response in both a number of field and engine tests especially with respect in controlling nitrooxidation reactions. Several different types of laboratory test were used in the antioxidant pre-screening process before engine evaluation. In addition oxidation inhibition of premium grade hydraulic oils using DPA-57 and AO-135 is briefly reviewed.

Key words: ashless, antioxidants, Caterpillar 1a engine, Mercedes M102 field test, laboratory oxidation test

SELECTED ASPECTS OF REDUCING HARMFUL SUBSTANCES EMISSIONS FROM MOBILE SOURCES

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The article analyzes briefly the potentialities of reducing emissions with emphasis laid on emissions produced in combustion engines of motor vehicles. The author analyzes two basic versions of reducing emissions for spark ignition and compression ignition and compression ignition engines with appropriate linkage on the EEC legislation. Mentioned are also some selected technological possibilities of reducing harmful substances of motor vehicles.

Key words: air pollution, harmful substances, motor vehicles, alternatives of reducing harmful substances emissions, technological possibilitie of reducing harmful substances.

MOLECULAR STRUCTURE AND EXTROGRAPHIC BEHAVIOUR OF HETEROCOMPOUNDS

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Elution behaviour of some polyaromatics and heterocompounds in extrographic fractionation was elucidated. Standard compounds were typical for coal derived liquids. Influence of polar centres of molecules as well as sterical hindrance of the polar groups and some inductive effects of substitutents on the separation behaviour of standard compounds were evaluated.

Key words: extrography, coal liquids

POSSIBILITIES OF THE DETERMINATION OF ALKYLSUBSTITUTED POLYAROMATIC HYDROCARBONS BY LSC, GC/MS AND HPLC/UV TECHNIQUES

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A method for determinationm of alkyl- and cycloalkyl-substituted polyaromatic hydrocarbons (PAHs) was described. Simple determination of these substituted PAHs in petroleum samples is complicated owing to inaccessibility of suitable analytical standards. The UV absorption and MS techniques in combination with high resolution GC and LC chromatography can be used for the identification of PAH derivatives. The analysis of UV spectra can give information about the type of aromatic skeleton of PAH isomers. The level and character of substitution or hydrogenation of PAH molecule can be determined on the base of mass spectroscopy.

Key words: petroleum, polyaromatic hydrocarbons, mass spectroscopy, HPLC, GC-MS

DESIGN OF CATALYST WITH NONUNIFORM ACTIVITY DISTRIBUTION FOR CONSECUTIVE REACTIONS - SELECTIVE HYDROGENATION OF ACETYLENE ON Pd/ALUMINA CATALYST

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The aim of this work is preparation of catalyst pellets with nonuniform activity distribution, evaluation of the kinetic and difusion parameters from experimental data for chosen catalytic and reaction systems. As a model reaction system the selective hydrogenation of acetylene in axcess of ethylene on the Pd/alumina catalyst was chosen. For our purposes three types of catalyst were prepared: 1. active component located on the surface of the catalyst pellet in a very thin layer (kinetic measurements), 2. active component located in a very thin layer under surface of the catalyst pellet and 3. active component located in the middle of catalyst pellet in the active zone (pellets 2 and 3 were used for diffusional parameters evaluations). The optimal position of the active component for chosen reactive and catalytic systems and operational conditions is a very thin zone in the middle of the catalyst pellet where the objective function (global selectivity) has its maximum.

Key words: catalyst activity distribution, catalyst preparation, impregnation of innert support, Pd/alumina catalyst, selctive hydrogenation of acetylene, kinetic measurements, kinetic parameters, global selectivity

TWO DIMENSIONAL CAPILLARY GAS CHROMATOGRAPHIC ANALYSIS OF C_9±C_{18} N-ALKANES IN KEROSENE TYPE PETROLEUM DISTILLATION FRACTIONS

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Analysis in single capillary (OV-1701) and two dimensional capillary gas chromatography (TDCGC using OV-1701 as a pre-column and SE-30 as an analytical column) were used for determination of individual C_9±C_{18} n-alkanes content in a kerosene like petroleum distillation fractions. Both analysis were performed under a temperature programmed mode in one oven. Zones of n-alkanes eluted from the pre-column were switched into the analytical column by switching valves using time programming mode. For calibration of

FID responses standard n-alkanes dissolved in deparaffinized kerosene fuel were used. Comparable results were obtained in single capillary and TDCGC for n-alkanes with content above 0.5%.

Key words: capillary gas chromatography, determination of n-alkanes in kerosene, two dimensional gas chromatography C9±C18 alkanes