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MICRO-FIBROUS CATALYSTS: NEW GENERATION OF STRUCTURED CATALYTIC SYSTEMS

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A lot of catalytic processes are performed under the significant influence of the diffusion limitations. Therefore, the development of the new catalysts with improved mass transfer properties is an important task. The possible promising solution in this area is application of structured catalytic systems using the catalyst on the base of microfibrous supports, produced in the form of cloths, made from glass, mineral, carbon, polymer and other micro-fibers. Such micro-fibrous catalysts (MFCs) may use noble metals (e.g. Pt or Pd) or transient metal (Cu, V, Fe, Ni, etc.) oxides as active components [1, 2]. The MFCs may be structured in a form of cartridges, characterized with a low pressure drop. There are also characterized with minimized mass transfer limitations both external and internal. As shown [3] by our theoretical estimation, the MFC's cartridges provide the highest unit mass transfer efficiency among all known forms of catalysts, thus highlighting the great engineering potential of structured fiber-glass catalytic systems.

The aim of the given study was to confirm this calculated result by direct experiments. Mass transfer properties of the MFC cartridges were studied in the reaction of deep oxidation of toluene in air flow using the Pt-containing (~0.07 % Pt mass) commercial glass-fiber catalyst IC-12S111 (BIC, Russia). Internal mass transfer limitations were eliminated for this catalyst by application of the very thin (<0.5 mm) catalytic fabric, giving the way to separately study the external mass transfer regularities. Experiments included variation of the reaction temperature, air flow rate and the geometry of catalytic cartridges. Pt-based monolith and granulated cata-

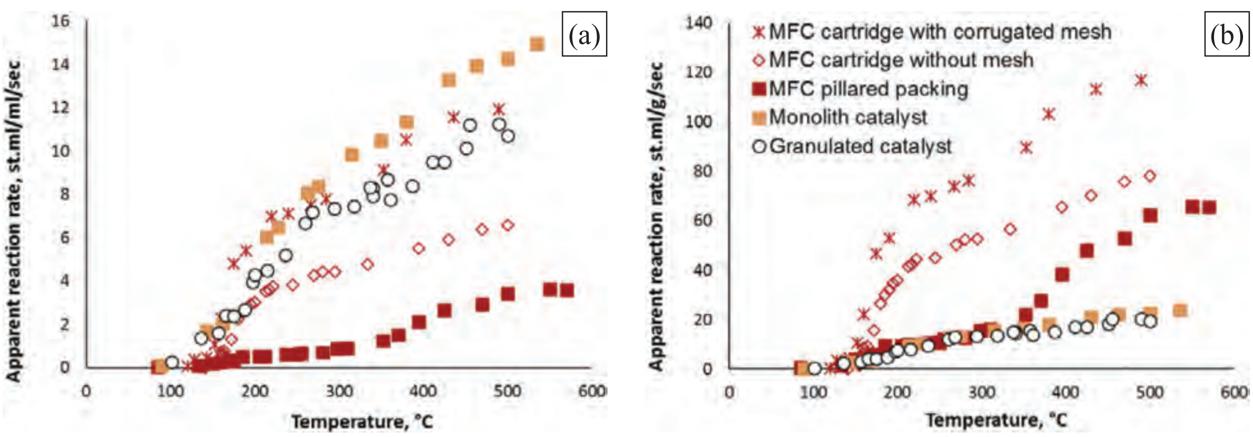

Fig. 1. *Dependence of the apparent reaction rate upon temperature in the catalyst beds of different structure: (a) – per unit volume of the catalyst bed, (b) – per unit mass of the catalyst*

lysts were used as reference catalysts for comparison. The volume of the catalytic cartridge was kept constant in all experiments, though in case of MFC the mass amount of the catalyst in this volume was much lower (less than 150 g per l of the bed) than that for the conventional catalysts.

The observed dependence of the apparent reaction rate upon temperature for different types of the catalyst packing is given in Fig.1. Comparison was made for temperature region above 200 °C, where the reaction was limited by the external mass transfer.

It is seen that the MFC in the form of cartridges with corrugated structuring wire mesh demonstrates the excellent volume performance competitive to that of the monolith catalyst (Fig.1a). At the same time, all MFCs look much more efficient than conventional catalysts in terms of apparent reaction rate per unit catalyst mass (Fig.1b). MFCs may be applied for intensification of many catalytic processes.

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QUALITY MONITORING OF DIESEL FUEL AVAILABLE AT FILLING STATIONS OF TOMSK CITY

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Diesel is one of the most popular types of motor fuel. Currently, diesel fuel is an important part of Russian transport system because most of the trucks and agricultural vehicles consumes diesel [1].

Basic physico-chemical and operational properties of diesel fuel produced in Russia are governed by three basic standards: USS 305-82, USS R 52368-2005 and Technical Regulations of the Customs Union "Requirements for automobile and aviation gasoline, diesel and marine fuel, jet fuel and heating oil". The most stringently controlled characteristics of diesel fuel are: cetane number, flash point, density, kinematic viscosity and low temperature properties (cloud point, cold filter plugging point, pour point).

Cetane index is the most important characteristic of diesel fuel used in internal combustion engines. Optimal performance of modern engines is achieved by using of diesel fuel with a cetane index from 45 to 55 points. If cetane index of diesel fuel is less than 45 points, the combustion delay (the time between the beginning of fuel injection and its ignition) is increased, and the pressure rate in the combustion chamber rises, thereby engine wear is increased. If cetane index is higher than 55 points, the combustion efficiency is reduced, and smokiness of diesel fuel as well as its consumption rises [2].

Experimental determination of cetane index is a multi-step and time-consuming process. That is why determination of cetane index in this study was performed using calculation methods. Allthe calculations were carried out basing on the international standard ISO 4264 where cetane index is calculated by the following equation:

$$CI = 45.2 + 0.0892 \cdot T_{10N} + (0.131 + 0.901B) \cdot T_{50N} + \\ + (0.0523 - 0.42B) \cdot T_{90N} + \\ + [0.00049 \cdot (T^2_{10N} - T^2_{90N})] + 107B + 60B^2;$$

$$T_{10N} = T_{10\%} - 215;\ T_{50N} = T_{50\%} - 260;$$
$$T_{90N} = T_{90\%} - 310;$$