A rapid method for catalyst testing. Zeolite catalysts for methanol conversion to hydrocarbon

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A rapid method for testing catalysts is suggested, which permits a 30-fold reduction in the time of their examination. The method is recommended for studying catalytic processes taking place with either evolution or absorption of heat.

Предложен экспресс-метод испытания катализаторов, позволяющий сократить время их исследования не менее чем в 30 раз. Предложено использовать этот метод для исследования любых катализтических процессов, протекающих с выделением или поглощением тепла.

INTRODUCTION

Catalytic processes have been extensively used in industry. In this connection new catalysts are being developed, but their tests require prolonged experiments. Thus, the determination of the time between regenerations for the operation of a zeolite catalyst to synthesize hydrocarbons from methanol, takes up to 1000 h. It complicates the development of new catalysts and hinders the control of their quality under production.

The suggested fast method to test catalysts permits not only a drastic reduction in the time required for the determination of the operation between regenerations, but also provides immediate information concerning several properties for the systems under examination. The method consists in the application of a movable thermocouple to obtain data on the catalyst operation at each point of the reactor.

EXPERIMENTAL

Zeolite catalysts of the pentasil group were applied for methanol conversion to hydrocarbons in a tube-type reactor with isothermal external walls (Fig. 1). To stabilize the temperature of its external walls and to maintain their isothermal state, the reactor was placed into a boiling liquid whose boiling point determines the reaction temperature. The reactor is almost isothermal but it is

71
intermediate between isothermal and adiabatic types, which is of principal importance, since in this case the temperature at point A is proportional to the heat evolution in $\Delta S$ of the element (Fig. 1).

Fig. 1. Reactor for studying the dynamics of methanol conversion to hydrocarbons

Fig. 2. Typical time variations in the temperature profile for pentasil-type catalysts. Reactant is methanol converted to the equilibrium mixture methanol-dimethyl ether-water