The catalytic activity of ZSM-5 zeolites containing Mg cations in various concentrations has been studied in the alkylation of toluene by ethylene. The concentration of acid centers of different nature in these zeolites was characterized by IR spectroscopy of OH-groups and adsorbed CO. The state of Mg cations in the samples was studied by $^{15}$N NMR of the adsorbed $N_2O$. The increase of Mg content was shown to decrease both the concentration of non-protic acid sites of medium strength and the activity of samples, which is related to the increase of association degree of Mg cations in the zeolite.

Chemical modification of ZSM-5 zeolites is known to increase drastically their para-selectivity in reactions of aromatics alkylation [1-7]. The majority of researchers believe that change of zeolite acidic properties due to modification is responsible for this phenomenon. The maximum effect was observed when there was no strong Brönsted and Lewis acid sites in the zeolite [5, 7]. The activity of the catalysts in this case was assumed to be related to acid centers of medium strength [7]. Lewis sites, formed upon modification of ZSM-5 zeolite with magnesium compounds, provide the most considerable effect.

We now consider the regulation of Mg-containing non-protic site formation in ZSM-5 zeolite, changing the catalytic properties.
Catalysts. Mg²⁺ cations from aqueous solutions were introduced via ion exchange into H-form of ZSM-5 zeolite (SiO₂/Al₂O₃ = 95±5). The total content of iron impurity in the parent zeolite did not exceed 0.036 wt.% of Fe₂O₃.

IR spectroscopy investigations. Sample pellets (8-10 mg/cm²) were calcined in an IR cell at 450°C in air for 1 h and then in vacuum (10⁻⁵ Pa) for 1 h. Spectra were recorded with a UR-20 spectrometer, specially modified for operating in a wide temperature range.

Concentration of non-protic acid sites was determined using the data on CO adsorption at low temperatures [8]. To identify more carefully the types of Lewis (non-protic) sites, CO adsorption was carried out in small doses (1-10 µmol per cell) to complete saturation of the active surface. To distinguish the individual band with ν_CO=2212-2215 cm⁻¹, the deconvolution of IR spectra was carried out with a CK-2 curve synthesizer. Concentration of non-protic sites was calculated from the line intensity of the adsorbed CO according to eq. 1, using the coefficients of integral absorption given in [9].

\[
C (\text{µmol/g}) = (A_0 \rho)^{-1} \int \log(T_o/T) d\nu 
\]

where \( A_0 \) is the coefficient of integral absorption, cm⁻¹/µmol; \( \rho \) is the surface density of the pellet, g/cm²; \( T_o \) and \( T \) are the IR transmissions (%) of an individual line by the pellet before and after CO adsorption, respectively.

Concentration of Brønsted (protic) sites was also calculated according to eq. 1 from both the intensity of the OH-group band (ν_ΟΗ=3610 cm⁻¹, \( A_0 = 7 \text{ cm}^{-1}/\text{µmol} \)) and that of the corresponding band of OH-groups in complexes with CO (ν_ΟΗ..CO=3310 cm⁻¹, \( A_0 = 57 \text{ cm}^{-1}/\text{µmol} \)).

₁⁵N NMR spectra. N₂O used for adsorption was enriched with ¹⁵N isotope to 60% for both N positions. Before adsorption, the catalysts were calcined in air at 550°C and then evacuated to 10⁻³ Pa at 500°C for 8-10 h. ¹⁵N NMR spectra were recorded with