



Support properties in applied to the formation of sulfur dioxide oxidation catalysts

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The distribution uniformity of the active component melt on the support surface in sulfuric acid vanadium catalysts depends on the adhesive properties of the supports [1-3]. It is known, that the modification of diatomite with vanadyl sulfate makes it possible decrease the contact wetting angle and increase the spreadability of the melt [1].

In this work was investigated the influence of the conditions of treatment of diatomite with a solution of vanadyl sulfate, 5.35-16.12 g/l, on the acid-base characteristics of its surface.

Materials and methods of research:

Diatomite with a particle size of the dominant fraction of 7-40 μm was used as a support.

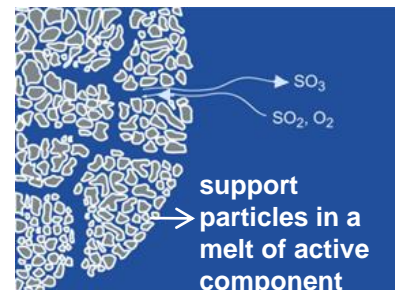
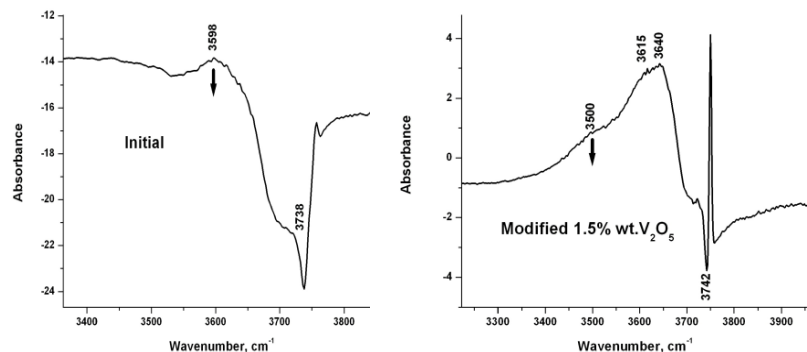
The chemical composition of diatomite was determined by inductively coupled plasma atomic emission spectrometry.

The chemical composition of diatomite

Compound	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	TiO ₂	MgO	K ₂ O	Na ₂ O
Content, % wt.	92.48	4.81	1.13	0.14	0.29	0.67	0.15

The surface acidity of the supports was determined by the method of weight titration Zërensena-de Bryuina by the point of zero charge (pH_{pzc}). The properties of the surface of diatomite were studied by low-temperature FT-IR spectroscopy of the adsorbed carbon monoxide and deuteriochloroform.

Difference IR spectrums of OH-groups of diatomite after adsorption of 0.0132 atm CO



Surface acidity of supports and catalyst activity

Support	pH _{pzc}	X _{SO₂} ^{420°C} , %
Initial diatomite	7.85	50.8
Diatomite (500°C, 4h)	5.75	51.1
1.5 % wt. V ₂ O ₅ on diatomite (500°C, 4h)	3.97	59.8

- Modifying of diatomite leads to a shift in the absorption band 3598 cm^{-1} to the low-frequency region (3500 cm^{-1}), which indicates on increase in the acidity of the diatomite surface and about specified adsorption of V₂O₅ on the base centers its of impurity oxides Al, Ti, Fe, and Mg.
- The point of zero charge of the diatomite after its modified 1.5% wt. V₂O₅ decreases in ~ 2 times.
- The activity of the catalyst obtained using the modified diatomite increases by 15% when tested catalytic activity of the samples in the kinetic region of the reaction at a volumetric flow rate of 10% vol. SO₂ in air 4000 h⁻¹ and T=420°C.

References:

- [1] N.V. Spiridonova, B.M. Maslennikov et.al. Proceedings of NIUIF, M., 1977, V.230, C.19-22
- [2] S.A. Lavrishcheva, L.A. Nefedova et.al. Chem. Chem. Tech., 2005, V.48, 1, C.105-109
- [3] F. Cavalca, P. Beato et.al. J. Phys. Chem. C, 2017, V.121, 6, C.3350–3364