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The Basic Investigation of Catalysts

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Most extensive scientific investigations are necessary for elucidating the nature of the catalytic reaction occurring in the high-pressure hydrogenation. Some of them can be handled within the framework of this laboratory.

The available equipment permits two types of projects:

- (a) the study of catalysts of various types, prepared by different methods;
- (b) the testing of selected catalysts and pure substances, or definite mixtures, commercial products and fractions of such products, within a wide range of pressures and temperatures;
- (c) other institutes could be supplied with selected catalyst specimens which had been tested in this laboratory. These specimens would be subjected to special chemical and physical investigations, the results of which would constitute a contribution to the interpretation of the catalytic effects. Such studies might embrace investigations by means of quantitative chemical and concentration analysis, X-ray, electron diffraction, adsorption measurements with gases, coloring matters, high-molecular substances, etc.

Our actual projects comprise the following tests with tungsten-catalysts:

- WS₂ from pure Mo-free tungstic acid.
- WS₂ from alkali-free yellow salt (Gelbsalz).
- WS₂ from yellow salt, which has been decomposed with hydrogen at various temperatures.
- WS₂ from yellow salt, subjected to thermal decomposition in a nitrogen atmosphere at various temperatures.
- WS₂ in various granule sizes.
- WS₂ to be reduced at 600 atm. and operated at 250 atm.
- WS₂ made from yellow salt, decomposed in the pressure apparatus without pressure and operation started without access of air.
- Tungsten trisulfide, treated with hydrogen at low temperature.
- Tungsten oxy-sulfide, with varying S-content.
- WS₂, treated under pressure with elementary S.
- WS₂, treated under pressure with H₂S.
- WS₂, used in technical operation, then treated with S under pressure (regeneration?).

WS₂, prepared with inhibiting substances or additives over yellow salt or over WO₃ (inhibiting substances or additives: As, Sb, Bi, Fe, Se, V, Al, Zn, Ti, Th, Co, P, Si, Fluorides, etc., further Mo, Cr, Mn, U, Fe, Co, Ni, Ag, Cu, etc.).

WS₂ on carriers.

WO₃ with H₂S-free gas and S-free product in a furnace lined with copper.

WO₃ reduction carried out at various temperatures.

H₂ pressures and with high gas velocities.

WO₃ converted into sulfide in the high-pressure furnace.

WO₃ upon carrier as compared with WS₂.

As a rule the catalysts are tested under the conditions of benzinstion (cracking of gas oil) and under the conditions of prehydrogenation (refining hydrogenation of anthracite liquefaction middle oil).

Moreover, we shall continue our tests with di-diobutylene, n-Heptane, iso-octane, benzene, toluene, tri-ethyl-benzene, tetraline, dekaline, pyrene, prehydro-pyrene, and coronene, including later on ethylene, normal butane, iso-butane, octane, tri-iso-butylene, phenols, alcohols, various nitrogen compounds, etc.

Some more tests are planned with the adjacent elements of tungsten and with the elements of the iron group.

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