UNITED STATES PATENT OFFICE.

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CATALYTIC AGENT.

1,256,032. Specification of Letters Patent. Patented Feb. 12, 1918.

No Drawing. Application filed June 4, 1914. Serial No. 843,023.

To all whom it may concern:

Be it known that we, ALWIN MITTASCH, CHRISTIAN SCHNEIDER, and HUGO MORAWITZ, citizens of the German Empire, residing at Ludwigshafen-on-the-Rhine, Germany, have invented new and useful Improvements in Catalytic Agents of which the following is a specification.

We have discovered new catalytic agents by means of which catalytic reactions can be carried out in a very advantageous manner. Our new catalytic agents contain the elements of nickel and an aluminate-silicate, and can be obtained by taking an aluminate-silicate containing water, such as a natural zeolite, or an artificial zeolite, and replacing a part, or the whole of the alkali metal or alkaline earth metal contained therein, by nickel. The product obtained can be subjected to further treatment, without departing from our invention; for instance, it may be heated and reduced, and this reduction is desirable, if the catalytic agent is to be employed for the hydrogenization of organic compounds. After such reduction, the catalytic agent contains metallic nickel and the elements of an aluminate-silicate.

The introduction of the nickel into the aluminate-silicate can be effected, for instance, by digesting the alkali metal aluminate-silicate, or other aluminate-silicate, with a solution of a nickel salt. Or, the zeolite can either direct, or after being gently heated, so that some of the water is driven off, be soaked in a solution of a nickel salt, so that the nickel salt enters the zeolite, and some replacement of the alkali metal or alkaline earth metal by nickel takes place, although the alkali remains in the mass. Artificial zeolites are put on to the market under the name of permutite, and are described in British Patent No. 23,706/12 and also in the article "On artificial zeolites" by Dr. Siedler on page 262 of the report of section 2 of the Seventh International Congress of Applied Chemistry held in London in 1909.

Catalytic agents in accordance with this invention are very easily produced and are characterized by excellent activity, and by their use, the most varied operations, such, for instance, as hydrogenization, reduction and oxidation can be carried out.

During the employment of our catalytic agents, they may undergo physical and chemical changes, and we wish to be understood as claiming the new catalytic agents, as above defined whether they may have undergone these changes or not.

The following example illustrates how one of our new catalytic agents can be prepared, but the invention is not limited to this example. The parts are by weight.

Example.

Treat a zeolite (for instance, commercial granular sodium permutite) several times with a warm 10% solution of nickel nitrate, washing well after each treatment, whereby the sodium, or potassium, or other strong replaceable base, is replaced by nickel. If the catalytic agent is to be used for hydrogenization purposes, dry the granular mass which contains, for instance, about 10% of nickel and reduce it with hyrogen at from 350° to 400° C. The catalytic agent so produced contains metallic nickel and is excellently suited for hydrogenizing various oils of either animal, vegetable, or mineral, origin, either by shaking or stirring the oil with the catalytic agent in the presence of hydrogen, or by passing the mixed hydrogen and oil through a stationary layer of the catalytic agent.

In this example instead of sodium permutite, potassium permutite, or other aluminate-silicates containing a replaceable base, or more than one replaceable base, can be employed, for instance, natural zeolites can be used, such as analcime, natrolite and chabasite.

If desired, other compounds can be introduced into the aluminate-silicate, in addition to the nickel compounds. For instance, to the nickel nitrate solution employed according to the foregoing example, small quantities of aluminium nitrate or of cobalt nitrate can be added, so that alumina or cobalt oxid enter the permutite. Further, organic salts of nickel, such as nickel acetate, can be employed for the introduction of the nickel.

The alkali metal aluminate-silicate can further be first converted into ammonium aluminate-silicate, for instance, by treatment with ammonium sulfate, and this ammonium aluminate-silicate can then be treated with a soluble nickel salt. Another variation consists in warming sodium aluminate-silicate or ammonium aluminate-silicate gently, say

at 150° C., and then soaking it with a solution of nickel nitrate drying the whole and reducing it.

Now what we claim is:—

1. A catalytic agent containing the elements of nickel and of an aluminate-silicate.

2. A catalytic agent containing the elements of nickel and of an alkali metal aluminate-silicate.

3. A catalytic agent containing the elements of nickel and of a zeolite.

4. A catalytic agent containing the elements of nickel and of an aluminate-silicate in a reduced form.

5. A catalytic agent containing the elements of nickel and of an alkali metal aluminate-silicate in a reduced form.

6. A catalytic agent containing the elements of nickel and of a zeolite in a reduced form.

7. The process of producing a catalytic agent by causing nickel to replace the whole or a part of the replaceable base of an aluminate-silicate containing water.

8. The process of producing a catalytic agent by causing nickel to replace the whole or a part of the alkali metal of an alkali metal aluminate-silicate containing water.

9. The process of producing a catalytic agent by causing nickel to replace the whole or part of the alkali metal of an artificial zeolite.

10. The process of producing a catalytic agent by causing nickel to replace the whole or a part of the replaceable base on an aluminate-silicate containing water and then treating the product with a reducing agent.

11. The process of producing a catalytic agent by causing nickel to replace the whole or a part of the alkali metal of an alkali metal aluminate-silicate containing water and then treating the product with a reducing agent.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

ALWIN MITTASCH.
CHRISTIAN SCHNEIDER.
HUGO MORAWITZ.

Witnesses:
CH. BECK,
J. ALEC. LLOYD.