Claims

1. A process for the production of a recycled catalyst comprising at least one metal M1 from group VIB, and/or at least one metal M2 from group VIII, optionally phosphorus and/or sulfur, and a support based on oxide(s), characterized in that said process comprises the recycling of at least a part of the metal or metals of a source catalyst comprising the metal M1 and/or the metal M2 common with the recycled catalyst to be produced, the process comprising:

   - an extraction by an extraction solution of the metal M1 and/or of the metal M2 from said source catalyst, in order to obtain a solution of extracted metal/metals, then - an impregnation of the support with an impregnation solution resulting from said solution of extracted metal/metals, in order to obtain an impregnated substrate, said extracted metal(s) remaining in the liquid phase from the extraction until the impregnation,

   wherein the extraction is carried out with a solution comprising a solvent and at least one organic compound having complexing properties.

2. The process as claimed in the preceding claim, characterized in that the extraction solution and the impregnation solution have at least one solvent in common.

3. The process as claimed in either of the preceding claims, characterized in that the extraction solution and the impregnation solution are acidic media.

4. The process as claimed in the preceding claim, characterized in that the extraction is carried out with a solution comprising an aqueous solvent, and at least one organic compound having complexing properties and also acidic properties.

5. The process as claimed in the preceding claim, characterized in that the extraction solution comprises a mineral acid, in particular phosphoric, nitric or boric acid.

6. The process as claimed in the preceding claim, characterized in that the organic compound comprises one or more chemical functions chosen from a carboxylic acid, phosphonic acid, sulfonic acid, alcohol, thiol, thioether, sulfone, sulfoxide, ether, aldehyde, ketone, ester, carbonate, amine, nitrile, imide, oxime, urea and amide function or also compounds including a furan ring or also sugars.

7. The process as claimed in one of claims 4 to 6, characterized in that the organic compound is chosen from one at least of the following compounds: formic acid, acetic acid, oxalic acid, malonic acid, glutaric acid, glycolic acid, lactic acid, tartronic acid, citric acid, tartaric acid, pyruvic acid, γ-ketovaleric acid, succinic acid, acetoacetic acid, gluconic acid, ascorbic acid, phthalic acid, salicylic acid, maleic acid, malic acid, fumaric acid, acrylic acid, thioglycolic acid, 2-hydroxy-4-methylthiobutanoic acid, glutamic acid, N-acetylglutamic acid, alanine, glycine,

cysteine, histidine, aspartic acid, N-acetylaspartic acid, 4-aminobutanoic acid, 1,2-cyclohexanediaminetetraacetic acid, ethylenediaminetetraacetic acid (EDTA), nitrilotriacetic acid (NTA), iminodiacetic acid (IDA), N-(2-hydroxyethyl)ethylenediamine-N,N′,N′-triacetic acid (HEDTA), diethylenetriaminepentaacetic acid (DTPA), bicine, tricine, 1-hydroxyethylidene-1,1 diphosphonic acid (HEDP or etidronic acid), nitrilotris(methylenephosphonic acid), diethylenetriaminepentakis(methylenephosphonic acid), 4-sulfophthalic acid, 3-(N morpholino)-2-hydroxy-1-propanesulfonic acid (MOPSO), 2-(4-pyridinyl)ethanesulfonic acid, phenol-4-sulfonic acid, thiodiacetic acid and diglycolic acid.

8. The process as claimed in one of claims 4 to 6, characterized in that the organic compound is chosen from one at least of the following compounds: dimethylglyoxime, methyl acetoacetate, ethyl acetoacetate, ethyl lactate, methyl glycolate, ethyl glycolate, dimethyl malate, diethyl malate, dimethyl tartrate, diethyl tartrate, ethyl 3-hydroxybutanoate, ethyl 3 ethoxypropanoate, methyl 3-methoxypropanoate, methyl 3-(methylthio)propanoate, ethyl 3 (methylthio)propanoate, ethylene glycol, diethylene glycol, triethylene glycol, a polyethylene glycol (with a molecular weight of between 200 and 1500 g/mol), propylene glycol, glycerol, 2 butoxyethanol, 2-(2-butoxyethoxy)ethanol, 2-(2-methoxyethoxy)ethanol, triethylene glycol dimethyl ether, a crown ether, acetophenone, 2,4-pentanedione, pentanone, glucose, fructose, sucrose, sorbitol, xylitol, mannitol, γ-valerolactone, propylene carbonate, octylamine, N,N diethylformamide, N,N-dimethylformamide, N-methylformamide, N,N-dimethylacetamide, propanamide, 1-methyl-2-pyrrolidinone, tetramethylurea, N,N′-dimethylurea, acetonitrile, lactamide, furfurol, 2-furaldehyde, 5-hydroxymethylfurfural, ethyl 3-hydroxybutanoate, 2 hydroxyethyl acrylate, 1-vinyl-2-pyrrolidinone, N,N,N',N'-tetramethyltartramide, 3-hydroxypropionitrile and N,N'-bis(2-hydroxyethyl)ethylenediamine.

9. The process as claimed in one of claims 4 to 8, characterized in that the concentration of organic compound(s) of the extraction solution is defined so that the organic compound/extracted metal(s) molar ratio, for the organic compound or for each of the organic compound(s), is of between 0.2 and 25, preferably between 0.2 and 11, preferably between 0.2 and 5, preferably between 0.4 and 2 and in a preferred way between 0.4 and 1.2.

10. The process as claimed in one of the preceding claims, characterized in that the recycling comprises at least one stage of treatment of the source catalyst, prior to the extraction by the liquid route, chosen from one at least of the following treatments: decoking, separation of compounds of contaminants/impurities type, mechanical grinding.

11. The process as claimed in one of the preceding claims, characterized in that the recycling comprises at least one stage of treatment of the solution of extracted metal/metals before impregnation, chosen from at least one of the following treatments: concentration, dilution, modification of the composition of the solution by complete or partial addition or removal of at least one compound.

12. The process as claimed in one of the preceding claims, characterized in that the impregnation of the support is carried out starting from the solution of extracted metal/metals and from a makeup of at least one of the metals M1, M2, and optionally of phosphorus and/or of organic additive(s).

13. The process as claimed in one of the preceding claims, characterized in that said process comprises:

- a sulfidation of the impregnated substrate.

14. The process as claimed in one of the preceding claims, characterized in that a part at least of the impregnation solution is reused after impregnation of the support, in particular as makeup for the extraction solution.

15. The process as claimed in one of the preceding claims, characterized in that the solution of extracted metal/metals is concentrated in order to withdraw therefrom a part at least of the solvent and optionally a part at least of the optional organic compound(s) which it contains, and in that at least a part of the solvent/of the organic compound(s) thus withdrawn is reused as makeup for the extraction solution.

16. The process as claimed in one of the preceding claims, characterized in that it comprises the following stages:

- at least one stage (a1, a2, a3) of treatment of the source catalyst,

- the extraction (b) with an extraction solution of the metal or metals of said source catalyst, in order to obtain a solution of extracted metal/metals,

- at least one optional stage (c) of purification of the solution of extracted metal/metals produced in stage (b) in order to withdraw therefrom all or some of possible impurities,

- at least one optional stage (d) of concentration of the solution of extracted metal/metals,

- at least one optional stage (e) of adjustment of the composition of the solution of extracted metal/metals resulting from stage (b), (c) or (d),

- the impregnation (f) by the liquid route of the support with an impregnation solution resulting from said solution of extracted metal/metals obtained in stage (b), (c), (d) or (e), with an optional makeup of metal/metals, of phosphorus and of organic additive(s), in order to obtain an impregnated substrate, said extracted metal or metals remaining in the liquid phase from the extraction as far as the impregnation,

- optional sulfidation (g) of the impregnated support obtained in stage (f).

17. The process as claimed in one of the preceding claims, characterized in that the source catalyst is a spent catalyst regenerated or rejuvenated beforehand.

18. The process as claimed in one of the preceding claims, characterized in that the support on which the impregnation is carried out with the impregnation solution resulting from the solution of extracted metal/metals is preimpregnated or postimpregnated with an impregnation solution or is a catalyst depleted in metal of the optionally regenerated/rejuvenated spent catalyst type.