Claims

1. Process for preparing a pulverulent, porous crystalline metal silicate, comprising the following steps:

(a) hydrothermal synthesis employing an aqueous mixture comprising

(A) a silicon source,

(B) a metal source, and

(C) an auxiliary component,

yielding an aqueous suspension of reaction product 1, comprising a raw porous crystalline metal silicate; and

(b) flame spray pyrolysis of reaction product 1, wherein the aqueous suspension obtained in step (a) is sprayed into a flame generated by combustion of a fuel in the presence of oxygen to form a pulverulent, porous crystalline metal silicate;

wherein the aqueous suspension comprising reaction product 1 obtained in step (a) exhibits a solids content of ≤ 70% by weight; and

wherein the effective peak temperature, T_{eff}, experienced by at least 90% by weight of the porous crystalline metal silicate during flame pyrolysis, is in the range $T_{min} < T_{eff} < T_{max}$, and

wherein T_{min} is ~~750~~ 850 °C, and

wherein T_{max} is ~~1250~~ 1100 °C, and

wherein the metal source (B) is a source of titanium (Ti), iron (Fe) or aluminium (Al), and

wherein the auxiliary component (C) is selected from the group consisting of organic bases, quaternary ammonium hydroxides and mixtures thereof.

2. Process according to claim 1, wherein component (A) is selected from the group consisting of pyrogenic silicon dioxide, precipitated silicon dioxide, silicon dioxide produced by a sol-gel process and mixtures thereof.

3. Process according to any one of claims 1 to 2, wherein in step (a), component (A) and component (B) are merged into a single component and this component is selected from the group consisting of amorphous mixed metal-silicon oxide, amorphous silicon dioxide doped with metal oxide, amorphous silicon dioxide impregnated with metal, metal silicate, metal-doped tetraalkyl orthosilicate and mixtures thereof.

4. Process according to any one of claims 1 to 3, wherein the metal source (B) is a source of titanium (Ti).

5. Process according to any one of claims 1 to 4, wherein the auxiliary component (C) is selected from the group consisting of quaternary ammonium hydroxides, diamines, diols and mixtures thereof.

6. Process according to any one of claims 1 to 5, wherein the auxiliary component (C) is selected from the group consisting of tetraethylammonium hydroxide, tetrapropylammonium hydroxide, tetrabutylammonium hydroxide, tetrapentylammonium hydroxide, 1,6-diaminohexane, 1,2 pentanediol and mixtures thereof.

7. Process according to claim 1, wherein

component (A) is selected from the group consisting of pyrogenic silicon dioxide, precipitated silicon dioxide, silicon dioxide produced by a sol-gel process and mixtures thereof, and wherein

the metal source (B) is a source of titanium (Ti), and wherein

auxiliary component (C) is selected from the group consisting of organic bases, quaternary ammonium hydroxides and mixtures thereof, and wherein

the porous crystalline metal silicate has a zeolite structure of MFI or MEL type, and wherein

the fuel used for flame spray pyrolysis is hydrogen.

8. Process according to claim 1, wherein

component (A) and component (B) are merged into a single component and this component is selected from the group consisting of amorphous mixed metal-silicon oxide, amorphous silicon dioxide doped with metal oxide, amorphous silicon dioxide impregnated with metal, metal silicate, metal-doped tetraalkyl orthosilicate and mixtures thereof, and wherein

the metal source (B) is a source of titanium (Ti), and wherein

auxiliary component (C) is selected from the group consisting of organic bases, quaternary ammonium hydroxides and mixtures thereof, and wherein

the porous crystalline metal silicate has a zeolite structure of MFI or MEL type, and wherein

the fuel used for flame spray pyrolysis is hydrogen.

9. Process according to any one of claims 1 to 8, wherein the auxiliary component is tetrapropylammonium hydroxide.

~~10. Process according to any one of claims 1 to 9, wherein T_{min} is 800 °C, and wherein T_{max} is 1200 °C.~~

~~11. Process according to any one of claims 1 to 9, wherein Tmin is 850 °C, and wherein Tmax is 1100 °C.~~

~~12~~10. Process according to any one of claims 1 to ~~11~~9, wherein the aqueous mixture in step (a) additionally comprises suitable seed crystals.

~~13~~11. Process according to any one of claims 1 to 6 and 9 to ~~12~~10, wherein the porous crystalline metal silicate has a zeolite structure of MFI or MEL type.

~~14~~12. Process according to any one of claims 1 to 6 and 9 to ~~13~~11, wherein the porous crystalline metal silicate has a zeolite structure of MFI type.

~~15~~13. Process according to any one of claims 1 to 6 and 9 to ~~14~~12, wherein the auxiliary component (C) is selected from the group consisting of quaternary ammonium hydroxides, diamines, diols and mixtures thereof, and wherein the metal source (B) is a source of titanium (Ti).

~~16~~14. Process according to any one of claims 1 to 6 and 9 to ~~15~~13, wherein the auxiliary component (C) is selected from the group consisting of tetraethylammonium hydroxide, tetrapropylammonium hydroxide, tetrabutylammonium hydroxide, tetrapentylammonium hydroxide, 1,6-diaminohexane, 1,2 pentanediol and mixtures thereof, and wherein the metal source (B) is a source of titanium (Ti).

~~17~~15. Process according to any one of claims 1 to 6 and 9 to ~~16~~14, wherein the auxiliary component (C) is tetrapropylammonium hydroxide, and wherein the metal source (B) is a source of titanium (Ti), and wherein the porous crystalline titanium silicate has a zeolite structure of MFI type.

~~18~~16. Process according to any one of claims 1 to 6 and 8 to ~~17~~15, wherein the fuel used for flame spray pyrolysis is hydrogen.

~~19~~17. Process according to any one of claims 1 to ~~18~~16, wherein the porous crystalline metal silicate obtained thereby exhibits a loss on ignition according to DIN 18128:2002-12 of less than 5% by weight.

~~20~~18. Process according to any one of claims 1 to ~~19~~17, wherein step (b) is followed by a shaping step (c) comprising the following substeps:

(1) adding water for obtaining an aqueous suspension of the pulverulent, porous crystalline metal silicate,

(2) mixing the suspension obtained in substep (1) with granulating aids,

(3) compacting, granulating, spray-drying, spray granulating and/or extruding the product obtained in substep (2) for obtaining a porous crystalline metal silicate in the form of microgranules, spheres, tablets, solid cylinders, hollow cylinders or honeycombs.