Both the steam treatment and the acid treatment have a significant influence on the properties of the zeolitic material. By subjecting a zeolitic material comprising both trivalent and tetravalent structural components X and Y as X_2O_3 and YO_2, respectively, to a steam and/or an acid treatment, the X_2O_3 : YO_2 molar ratio is decreased. However, it was found that, for example, the crystallinity of the zeolitic materials may be decreased by the steam treatment and/or the acid treatment. Also, it was found that the hydrophobicity of the zeolitic materials, characterized by the water uptake of the zeolitic material, decreases. Therefore, both the steam treatment and the acid treatment are believed to result in a partial transformation of the zeolitic material into an amorphous material and to change the hydrophobicity.

Therefore, it was an object of the embodiments disclosed herein to provide a process for the post-treatment of a zeolitic material which does not exhibit said disadvantage.

Further, it was an object of the embodiments disclosed herein to provide a post-treated zeolitic material having a low X_2O_3 : YO_2 molar ratio and simultaneously a high hydrophobicity. It was also an object of the embodiments disclosed herein to provide a post-treated zeolitic material having a low X_2O_3 : YO_2 molar ratio, a high hydrophobicity and at the same time a reduced concentration of internal defects such as silanol nests. In particular, it has been observed that the treatment of a zeolitic material for lowering the X_2O_3 : YO_2 molar ratio such as by steam and/or acid treatment leads to the increased formation of silanol nests which are for example characterized by an absorbtion band in the IR spectrum of the zeolitic material located in the range of from 3500 to 3550 cm^{-1}. Within the meaning of the present disclosure, the term "silanol nests" preferably refers to hydrogen-bonded Si-OH groups of which the characteristic absorption in the IR spectra of e.g. silicalites is found in the range of 3200 to 3650 cm^{-1}, as described in Zecchina et al. in *J. Phys. Chem.* **1992**, *96*, pp. 4991-4997.

It was surprisingly found that a post-treatment process which includes subjecting a zeolitic material to a treatment with a liquid solvent system to decrease the molar ratio X_2O_3 : YO_2 followed by a treatment with a liquid aqueous system having a pH in the range of 5.5 to 8 at elevated temperatures of at least 75 °C avoids that disadvantages. It was further surprisingly found that said treatment with the liquid aqueous system reduces the concentration of internal defects in the obtained zeolitic material.

In an aspect, there is provided a process for the post-treatment of a zeolitic material having a BEA framework structure, the process comprising

(i) providing a zeolitic material having a BEA framework structure,
wherein the framework structure of the zeolitic material comprises X_2O_3 and YO_2,
wherein Y is a tetravalent element and X is a trivalent element and wherein the molar ratio X_2O_3: YO_2 is greater than 0.02 : 1,
wherein Y is selected from the group consisting of Si, Sn, Ti, Zr, Ge, and combinations of two or more thereof

wherein X is selected from the group consisting of Al, B, In, Ga, Fe and combinations of two or more thereof;

(ii) treating the zeolitic material provided in (i) with a liquid solvent system thereby obtaining a zeolitic material having a molar ratio $X_2O_3 : YO_2$ of at most 0.02 : 1, and at least partially separating the zeolitic material from the liquid solvent system,
wherein the liquid solvent system is selected from the group consisting of water, monohydric alcohols, polyhydric alcohols, and mixtures of two or more thereof,
wherein in (ii), the treating is carried out at a temperature in the range of from 50 to 125 °C;

(iii) treating the zeolitic material obtained from (ii) with a liquid aqueous system having a pH in the range of 5.5 to 8 and a temperature of at least 75 °C,
wherein the water content of the liquid aqueous system is greater than 50 weight-%,
wherein in (iii), the zeolitic material is treated with the liquid aqueous system for a period in the range of from 0.5 to 24 h;

wherein the pH of the aqueous system used in (iii) is determined using a pH sensitive glass electrode.

In another aspect, there is provided a zeolitic material having a BEA framework structure, wherein the framework structure comprises YO_2 and X_2O_3, wherein Y is a tetravalent element and X is a trivalent element, said zeolitic material having a molar ratio $X_2O_3 : YO_2$ of at most 0.002 : 1 and a water uptake of at most 7 weight-%, wherein Y is selected from the group consisting of Si, Sn, Ti, Zr, Ge, and combinations of two or more thereof, wherein X is selected from the group consisting of Al, B, In, Ga, Fe and combinations of two or more thereof, wherein the zeolitic material has an IR spectrum exhibiting a first absorption band with the maximum in the range of from 3701 cm^{-1} to 3741 cm^{-1} and a second absorption band with the maximum in the range of from 3500 cm^{-1} to 3550 cm^{-1}, and wherein the ratio of the intensity of the first absorption band relative to the intensity of the second absorption band is in the range of from 1.4 to 2.6.

In another aspect, there is provided a zeolitic material, preferably the zeolitic material as defined above, obtainable or obtained by a process as defined above.

In another aspect, there is provided the use of a zeolitic material as defined above as a catalyst, as a catalyst support or a catalyst component.

Therefore, the present disclosure relates to a process for the post-treatment of a zeolitic material having a BEA framework structure, the process comprising

(i) providing a zeolitic material having a BEA framework structure, wherein the framework structure of the zeolitic material comprises X_2O_3 and YO_2, wherein the molar ratio $X_2O_3 : YO_2$ is greater than 0.02 : 1.

(ii) treating the zeolitic material provided in (i) with a liquid solvent system thereby obtaining a zeolitic material having a molar ratio $X_2O_3 : YO_2$ of at most 0.02 : 1,

Claims

1. A process for the post-treatment of a zeolitic material having a BEA framework structure, the process comprising

   (i) providing a zeolitic material having a BEA framework structure,
   wherein the framework structure of the zeolitic material comprises X_2O_3 and YO_2,
   wherein Y is a tetravalent element and X is a trivalent element and wherein the molar ratio X_2O_3: YO_2 is greater than 0.02 : 1,
   wherein Y is selected from the group consisting of Si, Sn, Ti, Zr, Ge, and combinations of two or more thereof
   wherein X is selected from the group consisting of Al, B, In, Ga, Fe and combinations of two or more thereof;

   (ii) treating the zeolitic material provided in (i) with a liquid solvent system thereby obtaining a zeolitic material having a molar ratio X_2O_3 : YO_2 of at most 0.02 : 1, and at least partially separating the zeolitic material from the liquid solvent system,
   wherein the liquid solvent system is selected from the group consisting of water, monohydric alcohols, polyhydric alcohols, and mixtures of two or more thereof,
   wherein in (ii), the treating is carried out at a temperature in the range of from 50 to 125 °C;

   (iii) treating the zeolitic material obtained from (ii) with a liquid aqueous system having a pH in the range of 5.5 to 8 and a temperature of at least 75 °C,
   wherein the water content of the liquid aqueous system is greater than 50 weight-%,
   wherein in (iii), the zeolitic material is treated with the liquid aqueous system for a period in the range of from 0.5 to 24 h;

   wherein the pH of the aqueous system used in (iii) is determined using a pH sensitive glass electrode.

2. The process of claim 1, wherein Y is Si, and X is B.

3. The process of claim 1 or 2, wherein in (i), at least 95 weight-%, preferably at least 98 weight-%, more preferably at least 99 weight-% of the framework structure of the zeolitic material consist of X_2O_3 and YO_2.

4. The process of any of claims 1 to 3, wherein in (i), the molar ratio X_2O_3 : YO_2 is at least 0.03 : 1, preferably in the range of from 0.03 : 1 to 0.07 : 1, more preferably from 0.03 : 1 to 0.06 : 1, more preferably from 0.03 : 1 to 0.05 : 1.

5. The process of any of claims 1 to 4, wherein prior to (ii), the zeolitic material provided in (i) is subjected to spray-drying, wherein during spray-drying, the drying gas inlet temperature is preferably in the range of from 200 to 250 °C and the drying gas outlet temperature is preferably in the range of from 100 to 175 ° C.

6. The process of any of claims 1 to 5, wherein prior to (ii), the zeolitic material provided in (i), optionally after spray-drying, is subjected to calcination.

7. The process of claim 6, wherein calcination is carried out at a temperature in the range of from 400 to 700 °C, preferably from 450 to 550 °C, for a period in the range of from 1 to 10 h, preferably from 3 to 6 h.

8. The process of any of claims 1 to 7, wherein in (ii), the liquid solvent system is selected from the group consisting of water, methanol, ethanol, propanol, ethane-1,2-diol, propane-1,2-diol, propane-1,3-diol, propane-1,2,3-triol, and mixtures of two or more thereof, preferably water, wherein preferably, the liquid solvent system does not contain an inorganic or organic acid, or a salt thereof.

9. The process of claim 8, wherein in (ii), the treating is carried out at a temperature in the range of from 90 to 115 °C, preferably from 95 to 105 °C, for a period in the range of from 6 to 20 h, preferably from 7 to 17 h, more preferably from 8 to 12 h.

10. The process of claim 9, wherein in (ii), the treating is carried under reflux.

11. The process of any of claims 1 to 10, wherein the zeolitic material obtained in (ii) has a molar ratio X_2O_3 : YO_2 of at most 0.01 : 1, preferably in the range of from 0.0005 : 1 to 0.01 : 1, more preferably from 0.0009 : 1 to 0.003 : 1.

12. The process of any of claims 1 to 11, wherein prior to (iii), the zeolitic material obtained from (ii) is subjected to spray-drying.

13. The process of any of claims 1 to 12, wherein the zeolitic material obtained from (ii) is in the form of a powder, preferably in the form of a spray powder.

14. The process of any of claims 1 to 13, wherein prior to (iii), the zeolitic material provided in (ii), optionally after spray-drying, is subjected to calcination.

15. The process of claim 14, wherein the calcination is carried out at a temperature in the range of from 400 to 700 °C, preferably from 500 to 600 °C, for a period in the range of from 1 to 10 h, preferably from 2 to 6 h.

16. The process of any of claims 1 to 15, wherein in (iii), the zeolitic material is treated with the liquid aqueous system for a period in the range of from 1 to 18 h, preferably from 8 to 14 h.

17. The process of any of claims 1 to 16, wherein in (iii), the zeolitic material is treated with the liquid aqueous system at a temperature in the range of from 75 to 200 °C, preferably from 90 to 180 °C, more preferably from 100 to 160 °C, more preferably from 110 to 150 °C.

18. The process of any of claims 1 to 17, wherein the liquid aqueous system used in (iii) has a pH in the range of from 6 to 7.5, preferably from 6.5 to 7.5.

19. The process of any of claims 1 to 18, wherein in (iii), the weight ratio of the liquid aqueous system relative to the zeolitic material is in the range of from 35 : 1 to 5 : 1, preferably from 30 : 1 to 10 : 1, more preferably from 25 : 1 to 15 : 1.

20. The process of any of claims 1 to 19, wherein in (iii), the liquid aqueous system comprises at least 90 weight-%, preferably al least 99 weight-%, more preferably at least 99.9 weight-% water.

21. The process of any of claims 1 to 20, wherein in (iii), the zeolitic material is treated with the liquid aqueous system in a closed system, preferably an autoclave, under autogenous pressure.

22. The process of any of claims 1 to 21, wherein the zeolitic material obtained from (iii) is subjected to calcination.

23. The process of claim 22, wherein calcination is carried out at a temperature in the range of from 350 to 600 °C, preferably from 400 to 500 °C, for a period in the range of from 1 to 10 h, preferably from 2 to 7 h.

24. The process of any of claims 1 to 23, wherein after (i) and/or after (ii) and/or after (iii), the zeolitic material is, prior to calcination, subjected to drying, wherein drying is preferably carried out at a temperature in the range of from 100 to 180 °C, preferably from 120 to 150 °C, for a period in the range of from 10 to 70 h, preferably from 15 to 25 h.

25. The process of any of claims 1 to 24, wherein neither prior to nor during nor after (iii), the zeolitic material is subjected to steam treatment and/or wherein neither during nor after (iii), preferably neither prior to nor during nor after (iii), the zeolitic material is subjected to a treatment with an aqueous solution having a pH of below 5.5 or above 8, wherein the pH of the aqueous system used in (iii) is determined using a pH sensitive glass electrode.

26. A zeolitic material having a BEA framework structure, wherein the framework structure comprises YO_2 and X_2O_3, wherein Y is a tetravalent element and X is a trivalent element, said zeolitic material having a molar ratio X_2O_3 : YO_2 of at most 0.002 : 1 and a water uptake of at most 7 weight-%, wherein Y is selected from the group consisting of Si, Sn, Ti, Zr, Ge, and combinations of two or more thereof, wherein X is selected from the group consisting of Al, B, In, Ga, Fe and combinations of two or more thereof, wherein the zeolitic material has an IR spectrum exhibiting a first absorption band with the maximum in the range of from 3701 cm^{-1} to 3741 cm^{-1} and a second absorption band with the maximum in the range of from 3500 cm^{-1} to 3550 cm^{-1}, and wherein the ratio of the intensity of the first absorption band relative to the intensity of the second absorption band is in the range of from 1.4 to 2.6.

27. The zeolitic material of claim 26, wherein the molar ratio X_2O_3 : YO_2 is in the range of from 0.0005 : 1 to 0.002 : 1 and the water uptake is at most 6 weight-%.

28. The zeolitic material of claim 26 or 27, wherein the zeolitic material has a crystallinity, as determined by XRD analysis, of at least 60 %, preferably in the range of from 60 to 90 %, a specific surface area of at most 600 m^2/g, preferably in the range of from 60 to 600 m^2/g, as determined according to DIN 66131, and an IR spectrum exhibiting a first absorption band with the maximum in the range of from 3701 cm^{-1} to 3741 cm^{-1} and a second absorption band with the maximum in the range of from 3500 cm^{-1} to 3550 cm^{-1}, wherein the ratio of the intensity of the first absorption band relative to the intensity of the second absorption band is in the range of from 1.5 to 2.5, preferably in the range of 1.6 to 2.4, more preferably in the range of from 1.7 to 2.3, and more preferably in the range of from 1.8 to 2.2.

29. The zeolitic material of any of claims 26 to 28, wherein Y is Si, and wherein X is B.

30. The zeolitic material of any of claims 26 to 29, being in the form of a powder, preferably in the form of a spray powder.

31. A zeolitic material, preferably the zeolitic material according to any of claims 26 to 30, obtainable or obtained by a process according to any of claims 1 to 25.

32. Use of a zeolitic material according to any of claims 26 to 31 as a catalyst, as a catalyst support or a catalyst component.