process, small cut-end angles are obtained. Furthermore, certain types of glass are not suitable for etching in acidic media.

DE 10 2013 103 370 A1 describes an etching process for glass structuring in a basic etching medium. This process too, however, has only very low etching rates of less than 8 µm per hour. Here as well, furthermore, there is the above-described problem of a local saturation of the etching solution within the structures. As a result of this etching process, therefore, the filaments initially generated are widened into channels, and the channel walls are deformed.

Object of the invention

It is therefore an object of the invention to provide a method for producing structured glass articles, or for glass working, that does not have the disadvantages described above and that enables the generation of structures with high shape fidelity in conjunction with a high etching rate for a multiplicity of different glass compositions. A further object of the invention is that of providing an etching solution for glass structuring with high shape fidelity and a high etching rate.

Summary

In one aspect, there is provided a method for producing a glass article, wherein a glass element is provided and glass material is removed from the glass element, the removal of the glass material taking place by an etching process in an etching medium, the etching medium provided comprising a basic aqueous etching solution having a pH > 12 and the etching solution comprising at least one complexing agent, the complexing agent complexing at least one of the leached constituents.

In another aspect, there is provided an aqueous etching solution for etching glass, more particularly for use in a method as described herein, wherein the etching solution has a pH > 12 and comprises at least one complexing agent, the complexing agent being configured to complex a complex with at least one constituent of the glass for etching.

Description of the invention

The object of the invention is already achieved by the subject matter of the independent claims. Advantageous embodiments and developments are subjects of the dependent claims.

In the method of the invention, a glass element is provided and glass material is removed locally or in selected regions by an etching process. For this, the glass element is contacted, at least in the regions to be structured, with an etching solution. The method preferably comprises a structuring process.

The etching solution is an aqueous basic solution and has a pH > 12. The etching solution also comprises at least one complexing agent, the complexing agent forming a complex in solution with at least one of the leached glass constituents. Formation of a complex is understood here to be, in particular, the formation of one or more coordinative bonds between the corresponding leached constituent and at least one complexing agent. The complexing agent here constitutes the ligand or ligands with which the corresponding glass constituent leached from the glass forms the complex.

Claims

1. A method for producing a glass article, wherein a glass element is provided and glass material is removed from the glass element, the removal of the glass material taking place by an etching process in an etching medium, the etching medium provided comprising a basic aqueous etching solution having a pH > 12 and the etching solution comprising at least one complexing agent, the complexing agent complexing at least one of the leached constituents.

2. The method as claimed in any of the preceding claims, wherein the etching solution has a pH of more than 13, preferably a pH of 14.

3. The method as claimed in one of the two preceding claims, wherein etching solution comprises potassium hydroxide (KOH) and/or sodium hydroxide (NaOH) as at least one basic component and/or the concentration of the hydroxide ions in the etching solution is in the range from 1 to 18 mol/l, preferably in the range from 6 to 12 mol/l.

4. The method as claimed in any of the preceding claims, wherein at least one of the complexing agents forms complexes with alkaline earth metal ions, preferably calcium ions (Ca^{2+}).

5. The method as claimed in any of the preceding claims, wherein the complexing agent is selected from the group of phosphates, preferably TTP, phosphonic acids, salts of hydroxycarboxylic acids, preferably alkali metal gluconates, EDTA, and/or transition metal salts, more particularly $CrCl_3$.

6. The method as claimed in any of the preceding claims, wherein the etching solution comprises a silicate, preferably an alkali metal silicate, more preferably waterglass, in dissolved form.

7. The method as claimed in any of the preceding claims, wherein the concentration of the complexing agent is 0.1 to 550 mmol/l.

8. The method as claimed in any of the preceding claims, wherein the glass element is a soda lime glass or borosilicate glass.

9. The method as claimed in any of the preceding claims, wherein the glass of the glass element comprises CaO, MgO and/or ZnO and the content of alkaline earth metals MO and ZnO is preferably subject to:
4 wt% < ∑ MO + ZnO < 15 wt%, more preferably 2 wt% <∑ MO + ZnO < 8 wt% and/or the content of CaO in the glass is at least 2 wt%.

10. The method as claimed in any of the preceding claims, wherein the method is carried out in an etching container, the etching container comprising a stainless steel tank.

11. An aqueous etching solution for etching glass, more particularly for use in a method as claimed in any of the preceding claims, wherein the etching solution has a pH > 12 and comprises at least one complexing agent, the complexing agent being configured to complex a complex with at least one constituent of the glass for etching.

12. The etching solution as claimed in the preceding claim, wherein the etching solution has a pH > 13, preferably of 14, and/or the concentration of the hydroxide ions in the etching solution is in the range from 1 to 18 mol/l, preferably in the range from 6 to 12 mol/l and more preferably in the 1 to 5 mol/l range.

13. The etching solution as claimed in one of the two preceding claims, wherein the complexing agent is selected from the group of phosphates, preferably TTP, chelating agents, more particularly EDTA and/or alkali metal salts of hydroxy-carboxylic acids, more particularly alkali metal glyconates, surfactants, and/or

transition metal salts, more particularly $CrCl_3$, and/or the concentration of the complexing agent is 0.1 to 550 mmol/l.

14. The aqueous etching solution for etching glass, wherein the etching solution has a pH > 12 and comprises at least one silicate in dissolved form.

15. The etching solution as claimed in the preceding claim, wherein the etching solution comprises an alkali metal silicate, preferably waterglass, in dissolved form and/or the concentration of the silicate is at least 10 mmol/l, more preferably 0.1 mol/l to 1 mol/l.