Claims

1. A process for preparing an amine by reacting a primary or secondary alcohol, aldehyde and/or ketone with hydrogen and a nitrogen compound selected from the group of ammonia and primary and secondary amines, in the presence of a supported copper-, nickel- and cobalt-containing catalyst, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises oxygen compounds of aluminum, of copper, of nickel and of cobalt, and in the range from 0.2 to 5.0% by weight of oxygen compounds of tin, calculated as SnO.

2. The process according to claim 1, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from 0.4 to 4.0% by weight of oxygen compounds of tin, calculated as SnO.

3. The process according to claim 1, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from 0.6 to 3.0% by weight of oxygen compounds of tin, calculated as SnO.

4. The process according to any of the preceding claims, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from 5.0 to 35% by weight of oxygen compounds of cobalt, calculated as CoO.

5. The process according to any of the preceding claims, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from 10 to 30% by weight of oxygen compounds of cobalt, calculated as CoO.

6. The process according to any of the preceding claims, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from
15 to 80% by weight of oxygen compounds of aluminum, calculated as Al_2O_3,
1.0 to 20% by weight of oxygen compounds of copper, calculated as CuO, and
5.0 to 35% by weight of oxygen compounds of nickel, calculated as NiO.

7. The process according to any of claims 1 to 5, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from
30 to 70% by weight of oxygen compounds of aluminum, calculated as Al_2O_3,
2.0 to 18% by weight of oxygen compounds of copper, calculated as CuO, and
10 to 30% by weight of oxygen compounds of nickel, calculated as NiO.

8. The process according to any of the preceding claims, wherein the molar ratio of nickel to copper in the catalyst is greater than 1.

9. The process according to any of the preceding claims, wherein the catalytically active material of the catalyst does not comprise any rhenium and/or ruthenium.

10. The process according to any of the preceding claims, wherein the catalytically active material of the catalyst does not comprise any iron and/or zinc.

11. The process according to any of the preceding claims, wherein the catalytically active material of the catalyst does not comprise any oxygen compounds of silicon and/or of zirconium.

12. The process according to any of the preceding claims, wherein the BET surface area of the catalyst (ISO 9277:1995) is in the range from 30 to 250 m^2/g.

13. The process according to any of the preceding claims, wherein the reaction is performed at a temperature in the range from 80 to 350°C.

14. The process according to any of the preceding claims, wherein the reaction is performed in the liquid phase at an absolute pressure in the range from 5 to 30 MPa, or in the gas phase at an absolute pressure in the range from 0.1 to 40 MPa.

15. The process according to any of the preceding claims, wherein the amine component (nitrogen compound) is used in 0.90 to 100 times the molar amount based on the alcohol, aldehyde and/or ketone used.

16. The process according to any of the preceding claims, wherein the catalyst is arranged as a fixed bed in the reactor.

17. The process according to any of the preceding claims, which is performed continuously.

18. The process according to the preceding claim, wherein the reaction is effected in a tubular reactor.

19. The process according to either of the two preceding claims, wherein the reaction is effected in a cycle gas method.

20. The process according to any of the preceding claims, wherein the alcohol, aldehyde and/or ketone is used as an aqueous solution.

21. The process according to any of the preceding claims, wherein the ammonia or the primary or secondary amine is used as an aqueous solution.

22. The process according to any of the preceding claims for preparing monoaminodiglycol (ADG) and morpholine by reacting diethylene glycol (DEG) with ammonia.

23. The process according to any of claims 1 to 21 for preparing N-(C_{1-4}-alkyl)-morpholine by reacting diethylene glycol (DEG) with mono(C_{1-4}-alkyl)amine.

24. The process according to any of claims 1 to 21 for preparing 2-(2-di(C_{1-4}-alkyl)aminoethoxy)ethanol and/or bis(2-di(C_{1-4}-alkyl)aminoethyl) ether by reacting diethylene glycol (DEG) with di(C_{1-4}-alkyl)amine.

25. The process according to any of claims 1 to 21 for preparing monoethanolamine (MEOA) and/or 1,2-ethylenediamine (EDA) by reacting monoethylene glycol (MEG) with ammonia.

26. The process according to any of claims 1 to 21 for preparing 1,2-ethylenediamine 6(EDA) by reacting monoethanolamine (MEOA) with ammonia.

27. The process according to any of claims 1 to 21 for preparing a polyetheramine by reacting a corresponding polyether alcohol with ammonia.

28. The process according to any of claims 1 to 21 for preparing piperazine and/or diethylenetriamine (DETA) by reacting N-(2-aminoethyl)ethanolamine (AEEA) with ammonia.

29. The process according to any of claims 1 to 21 for preparing polyisobuteneamine (PIBA) by reacting polyisobutenealdehyde with ammonia.

30. A catalyst, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises oxygen compounds of aluminum, of copper, of nickel and of cobalt, and in the range from 0.2 to 5.0% by weight of oxygen compounds of tin, calculated as SnO.

31. The catalyst according to the preceding claim, characterized as defined in any of claims 2 to 12.

The invention claimed is:

1. A process for preparing an amine by reacting a primary or secondary alcohol, aldehyde and/or ketone with hydrogen and a nitrogen compound selected from the group of ammonia and primary and secondary amines, in the presence of a supported copper-, nickel- and cobalt-containing catalyst, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises oxygen compounds of aluminum, of copper, of nickel and of cobalt, and in the range from 0.2 to 5.0% by weight of oxygen compounds of tin, calculated as SnO.

2. The process according to claim **1**, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from 0.4 to 4.0% by weight of oxygen compounds of tin, calculated as SnO.

3. The process according to claim **1**, wherein the catalytically active material of the catalyst, before the reduction

thereof with hydrogen, comprises in the range from 0.6 to 3.0% by weight of oxygen compounds of tin, calculated as SnO.

4. The process according to claim **1**, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from 5.0 to 35% by weight of oxygen compounds of cobalt, calculated as CoO.

5. The process according to claim **1**, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from 10 to 30% by weight of oxygen compounds of cobalt, calculated as CoO.

6. The process according to claim **1**, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from 15 to 80% by weight of oxygen compounds of aluminum, calculated as Al_2O_3, 1.0 to 20% by weight of oxygen compounds of copper, calculated as CuO, and 5.0 to 35% by weight of oxygen compounds of nickel, calculated as NiO.

7. The process according to claim **1**, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from 30 to 70% by weight of oxygen compounds of aluminum, calculated as Al_2O_3, 2.0 to 18% by weight of oxygen compounds of copper, calculated as CuO, and 10 to 30% by weight of oxygen compounds of nickel, calculated as NiO.

8. The process according to claim **1**, wherein the molar ratio of nickel to copper in the catalyst is greater than 1.

9. The process according to claim **1**, wherein the catalytically active material of the catalyst does not comprise any rhenium and/or ruthenium.

10. The process according to claim **1**, wherein the catalytically active material of the catalyst does not comprise any iron and/or zinc.

11. The process according to claim **1**, wherein the catalytically active material of the catalyst does not comprise any oxygen compounds of silicon and/or of zirconium.

12. The process according to claim **1**, wherein the BET surface area of the catalyst (ISO 9277:1995) is in the range from 30 to 250 m^2/g.

13. The process according to claim **1**, wherein the reaction is performed at a temperature in the range from 80 to 350° C.

14. The process according to claim **1**, wherein the reaction is performed in the liquid phase at an absolute pressure in the range from 5 to 30 MPa, or in the gas phase at an absolute pressure in the range from 0.1 to 40 MPa.

15. The process according to claim **1**, wherein the amine component (nitrogen compound) is used in 0.90 to 100 times the molar amount based on the alcohol, aldehyde and/or ketone used.

16. The process according to claim **1**, wherein the catalyst is arranged as a fixed bed in the reactor.

17. The process according to claim **1**, which is performed continuously.

18. The process according to claim **17**, wherein the reaction is effected in a tubular reactor.

19. The process according to claim **17**, wherein the reaction is effected in a cycle gas method.

20. The process according to claim **1**, wherein the alcohol, aldehyde and/or ketone is used as an aqueous solution.

21. The process according to claim **1**, wherein the ammonia or the primary or secondary amine is used as an aqueous solution.

22. The process according to claim **1** for preparing monoaminodiglycol (ADG) and morpholine by reacting diethylene glycol (DEG) with ammonia.

23. The process according claim **1** for preparing N-(C_{1-4}-alkyl)-morpholine by reacting diethylene glycol (DEG) with mono(C_{1-4}-alkyl)amine.

24. The process according to claim **1** for preparing 2-(2-di(C_{1-4}-alkyl)aminoethoxy)ethanol and/or bis(2-di(C_{1-4}-alkyl) aminoethyl) ether by reacting diethylene glycol (DEG) with di(C_{1-4}-alkyl)amine.

25. The process according claim **1** for preparing monoethanolamine (MEOA) and/or 1,2-ethylenediamine (EDA) by reacting monoethylene glycol (MEG) with ammonia.

26. The process according to claim **1** for preparing 1,2-ethylenediamine 6(EDA) by reacting monoethanolamine (MEOA) with ammonia.

27. The process according to claim **1** for preparing a polyetheramine by reacting a corresponding polyether alcohol with ammonia.

28. The process according to claim **1** for preparing piperazine and/or diethylenetriamine (DETA) by reacting N-(2-aminoethyl)ethanolamine (AEEA) with ammonia.

29. The process according claim **1** for preparing polyisobuteneamine (PIBA) by reacting polyisobutenealdehyde with ammonia.

30. A catalyst, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises oxygen compounds of aluminum, of copper, of nickel and of cobalt, and in the range from 0.2 to 5.0% by weight of oxygen compounds of tin, calculated as SnO.

31. The catalyst according to claim **30**, wherein the catalytically active material of the catalyst, before the reduction

thereof with hydrogen, comprises in the range from 0.4 to 4.0% by weight of oxygen compounds of tin, calculated as SnO.

32. The catalyst according to claim **30**, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from 0.6 to 3.0% by weight of oxygen compounds of tin, calculated as SnO.

33. The catalyst according to claim **30**, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from 5.0 to 35% by weight of oxygen compounds of cobalt, calculated as Co0.

34. The catalyst according to claim **30**, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from 10 to 30% by weight of oxygen compounds of cobalt, calculated as CoO.

35. The catalyst according to claim **30**, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from

15 to 80% by weight of oxygen compounds of aluminum, calculated as $A1_20_3$,

1.0 to 20% by weight of oxygen compounds of copper, calculated as CuO, and

5.0 to 35% by weight of oxygen compounds of nickel, calculated as NIO.

36. The catalyst according to claim **30**, wherein the catalytically active material of the catalyst, before the reduction thereof with hydrogen, comprises in the range from

30 to 70% by weight of oxygen compounds of aluminum, calculated as Al_2O_3,

2.0 to 18% by weight of oxygen compounds of copper, calculated as CuO, and

10 to 30% by weight of oxygen compounds of nickel, calculated as NiO.

37. The catalyst according to claim **30**, wherein the molar ratio of nickel to copper in the catalyst is greater than 1.

38. The catalyst according to claim **30**, wherein the catalytically active material of the catalyst does not comprise any rhenium and/or ruthenium.

39. The catalyst according to claim **30**, wherein the catalytically active material of the catalyst does not comprise any iron and/or zinc.

40. The catalyst according to claim **30**, wherein the catalytically active material of the catalyst does not comprise any oxygen compounds of silicon and/or of zirconium.

41. The catalyst according to claim **30**, wherein the BET surface area of the catalyst (ISO 9277:1995) is in the range from 30 to 250 m^2/g.

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