CLAIMS

1. A nanocage-confined catalyst, characterized in that the catalyst has an active center of formula (I-1) and/or (I-2):

M(Salen1)X (I-1)

M' (Salen2) (I-2)

such that the catalyst has formula (I):

NC-m[M(Salen1)X] -n[M' (Salen2)] (I)

wherein:

NC is a material having a nanocage structure,

each occurrence of M is independently selected from the group consisting of Co ion, Fe ion, Ga ion, Al ion, Cr ion, and a mixture thereof; and each occurrence of M' is independently selected from Cu ion, Ni ion and a mixture thereof;

m is an integer of 0 to 100, n is 2 or more, and each occurrence of M' (Salen2) is different for formula (I-2);

each occurrence of Salen1 and Salen2 is independently a derivative of a Shiff base;

X is an axial anion, wherein each occurrence of X is independently selected from the group consisting of substituted or unsubstituted acetate, substituted or unsubstituted benzenesulfonate, substituted or unsubstituted benzoate, F^-, Cl^-, Br^-, I^-, SbF_6^-, PF_6^-, BF_4^- and a mixture thereof; provided that:

(1) when X is a substituted or unsubstituted acetate, a substituted or unsubstituted benzenesulfonate, or a substituted or unsubstituted benzoate, then M is not a Co ion, or

(2) when X is F^-, Cl^-, Br^-, or I^-, then m is not less than 2, and at least one occurrence of X in formula (I-1) is SbF_6^-.

2. The catalyst according to claim 1, characterized in that each occurrence of M in formula (I-1) is independently selected from Co^{3+}, Fe^{3+}, Ga^{3+}, Al^{3+}, Cr^{3+} and a mixture thereof, and/or each occurrence of M' in

formula (I-2) is independently selected from Cu^{2+}, Ni^{2+} and a mixture thereof.

3. The catalyst according to claim 1, characterized in that m is 0 to 20, preferably 0 to 10, or preferably 0 to 5, e.g., 0 to 2.

4. The catalyst according to claim 1, characterized in that m is 0-2.

5. The catalyst according to claim 1, characterized in that m is 1, and X is selected from the group consisting of substituted or unsubstituted acetate, substituted or unsubstituted benzenesulfonate, substituted or unsubstituted benzoate, SbF_6^-, PF_6^-, and BF_4^-.

6. The catalyst according to claim 1, characterized in that m is 2, and each occurrence of M(Salen1)X of formula (I-1) is different, so as to form a catalyst of formula (II):

NC-[M(Salen1)X]-[M(Salen1)X]-n[M' (Salen2)] (II);

in formula (II), each occurrence of M is different and independently selected from Co^{3+}, Fe^{3+}, Ga^{3+}, Al^{3+}, and Cr^{3+}, and each Salen1 is same or different.

7. The catalyst according to claim 6, characterized in that one occurrence of X is SbF_6^-, and the other occurrence of X is F^-, Cl^-, Br^- or I^-.

8. The catalyst according to claim 1, characterized in that m is 2 or more, and each occurrence of M(Salen1)X is different for formula (I-1).

9. The catalyst according to claim 1, characterized in that the NC is mesoporous silica nanoparticles having a nanocage structure or organic hybrid mesoporous silica nanoparticles having a nanocage structure.

10. The catalyst according to claim 1, characterized in that NC is selected from SBA-6, SBA-16, FDU-1, FDU-12, KIT-5, and AMS-8.

11. The catalyst according to claim 1, characterized in that the Shiff base derivative is N,N’-disalicylidene-1,2-cyclohexanediamine or substituted N,N'-disalicylidene-1,2-cyclohexanediamine.

12. A nanocage-confined catalyst, characterized in that the catalyst has formula (II-3):

NC-[Co(Salen1)SbF_6-M(Salen1)X] (II-3),

wherein NC and Salen1 are each independently as defined in any one of the preceding claims; X is selected from F^-, Cl^-, Br^-, and I^-; and M is selected from Co^{3+}, Fe^{3+}, Ga^{3+}, Al^{3+} and Cr^{3+}.

13. A nanocage-confined catalyst, characterized in that the catalyst has formula (II-4):

NC-[M(Salen1)SbF_6-Co(Salen1)X] (II-4),

wherein NC and Salen1 are each independently as defined in any one of the preceding claims; X is selected from F^-, Cl^-, Br^-, and I^-; and M is selected from Co^{3+}, Fe^{3+}, Ga^{3+}, Al^{3+} and Cr^{3+}.

14. A nanocage-confined catalyst, characterized in that the catalyst has formula (III-1) or (III-2):

NC-[Co(Salen1)PF_6] (III-1), or

NC-[Co(Salen1)BF_4] (III-2),

wherein NC and Salen1 are each independently as defined in any one of the preceding claims.

15. A process of preparing a nanocage-confined catalyst according to claim 1, comprising the steps of:

adding an active center M(Salen1)X or M' (Salen2) and a nanocage material NC into a solvent, and stirring; removing the solvent; and encapsulating, to obtain the nanocage-confined catalyst.

16. The process according to claim 15, characterized in that M comprises Fe^{3+}, Ga^{3+}, Al^{3+}, and Cr^{3+}, M' comprises Cu^{2+} and Ni^2; Salen1 and Salen2 are respectively a Shiff base derivative, X is an axial anion, and the X comprises acetate, benzene sulfonate, benzoate, substituted acetate, substituted benzene sulfonate, substituted benzoate, F^-, Cl^-, Br^-, I^-, SbF_6^-, PF_6^-, and BF_4^-.

17. The process according to claim 15, characterized in that the solvent comprises at least one of dichloromethane, ethanol, and methanol.

18. Use of a catalyst according to any one of claims 1 to 14 or a catalyst obtained by a process according to any one of claims 15 to 17 in a reaction for producing glycol by hydration of alkylene oxide.