Claims

1. A method for producing a carbonate ester, comprising a step of allowing a monohydric alcohol and carbon dioxide to react with each other in the presence of a catalytic structure and a hydration agent to produce a carbonate ester, wherein:

the catalytic structure comprises a base material, which is a catalyst-supporting structure for supporting a solid catalyst and a catalytic layer which is formed on at least a part of the surface of the base material and which contains the solid catalyst and an inorganic binder;

the solid catalyst contains cerium oxide;

the amount of the supported solid catalyst is 15 g/m^2 to 200 g/m^2; and

the inorganic binder contains silica and/or alumina;

wherein the hydration agent contains a nitrile compound.

2. The method for producing a carbonate ester according to Claim 1, wherein the inorganic binder contains silica.

3. The method for producing a carbonate ester according to either one of Claims 1 and 2, wherein the catalytic structure further comprises an intermediate layer consisting of the inorganic binder, formed between the catalytic layer and the base material.

4. The method for producing a carbonate ester according to any one of Claims 1-3, wherein the amount of the supported solid catalyst is 15 g/m^2 to 150 g/m^2.

5. The method for producing a carbonate ester according to any one of Claims 1-3, wherein the amount of the supported solid catalyst is 15 g/m^2 to 70 g/m^2.

6. The method for producing a carbonate ester according to any one of Claims 1-5, wherein the base material has through-holes that serve as flow paths for the monohydric alcohol and carbon dioxide, and

the catalytic layer is formed on the surface of the through-holes.

7. The method for producing a carbonate ester according to any one of Claims 1-6, wherein the solid catalyst further contains an oxide of a rare-earth element.

8. The method for producing a carbonate ester according to Claim 7, wherein the solid catalyst contains lanthanum oxide.

9. The method for producing a carbonate ester according to any one of Claims 1-8, wherein the average thickness of the catalytic layer is 12 μm-180 μm.

10. The method for producing a carbonate ester according to any one of Claims 1-9, wherein the base material is a metal honeycomb.

11. The method for producing a carbonate ester according to any one of Claims 1-10, wherein the hydration agent is a nitrile compound.

12. The method for producing a carbonate ester according to any one of Claims 1-11, wherein the hydration agent contains 2-cyanopyridine.

13. A device for producing a carbonate ester from a monohydric alcohol and carbon dioxide, said device comprising:

a catalytic structure which comprises:

a base material, which is a catalyst-supporting structure for supporting a solid catalyst; and

a catalytic layer which is formed on at least a part of the surface of the base material and which contains the solid catalyst and an inorganic binder,

wherein:

the solid catalyst contains cerium oxide;

the amount of the supported solid catalyst is 15 g/m^2 to 200 g/m^2; and

the inorganic binder contains silica and/or alumina; and

a supply path for supplying at least the monohydric alcohol and carbon dioxide to the catalytic structure.

14. The device for producing a carbonate ester according to Claim 13, wherein the amount of the supported solid catalyst is 15 g/m^2 to 150 g/m^2.

15. The device for producing a carbonate ester according to Claim 13, further comprising a discharge path through which a carbonate ester generated from the monohydric alcohol and carbon dioxide passes.

16. The device for producing a carbonate ester according to either one of Claims 13 to 15 , wherein a plurality of catalytic structures are arranged in line.

17. The device for producing a carbonate ester according to either one of Claims 13 to 15, comprising an integrated structure having a plurality of catalytic structures arranged in parallel.

18. A method for producing a carbonate ester, the method comprising a step of circulating a reaction substrate containing the monohydric alcohol and carbon dioxide through the device for producing a carbonate ester according to any one of Claims 13 to 17 at space velocity (per minute) of 0.005 to 5000.