We claim:

1. A magnesium-based solid with a multimodal pore distribution, which comprises a magnesium halide as a carrier and titanium element, wherein, the magnesium-based solid has a specific surface area, as determined by a nitrogen adsorption method, of not less than $50m^2/g$ and a pore size distribution, as measured with nitrogen adsorption method and calculated with NLDFT algorithm in a range of from 1 nm to 300 nm, wherein there are at least one peak within the pore size range of less than 10 nm and at least one peak within the pore size range of not less than 10 nm; the peak within the pore size range of less than 10 nm has a most probable pore size of from 2 nm to 8 nm, and preferably from 2 nm to 6 nm, and the peak within the pore size range of not less than 10 nm has a most probable pore size of from 15 nm to 200 nm, preferably from 20 nm to 100 nm, and more preferably from 30 nm to 90 nm.

2. The magnesium-based solid as claimed in claim 1, characterized in that in the magnesium-based solid, the ratio of the pore volume of pores with a pore size of less than 10 nm to the pore volume of pores with a pore size of not less than 10 nm is (0.1-20):1, and preferably (0.25-15): 1.

3. The magnesium-based solid as claimed in claim 1 or 2, characterized in that the pore volume of pores with a pore size of less than 5 nm accounts for 10% to 90% of the total pore volume, and preferably 15% to 70%; and the pore volume of pores with a pore size of not less than 30 nm accounts for 5% to 70% of the total pore volume, and preferably 10% to 60%.

4. A method for preparing the magnesium-based solid as claimed in any one of claims 1 to 3, comprising:

S1. contacting a magnesium halide with a Lewis base in an organic solvent to form a magnesium-containing solution;

S2. contacting the magnesium-containing solution with an inert dispersion medium and a Lewis acid to form a mixture;

S3. in the presence of an auxiliary precipitant and a surfactant, precipitating the magnesium-based solid from the mixture,

wherein, in step S1, the Lewis base includes an organic phosphorus compound, which is used in an amount of from 1.5 to 10 moles, preferably from 2 to 5 moles, per mole of the magnesium halide; more preferably, the Lewis base further includes an organic epoxy compound; and in step S2, the Lewis acid includes a titanium compound, and

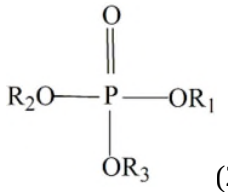
wherein the organic solvent is one or more selected from the group consisting of aromatic hydrocarbon compounds and halogenated hydrocarbon compounds, and the inert dispersion medium is one or more selected from the group consisting of kerosenes, paraffin oils, white oils, vaseline oils, methyl silicone oils, aliphatic and cycloaliphatic hydrocarbons.

5. The method as claimed in claim 4, characterized in that in step S1, the magnesium halide is represented by a general formula (1):

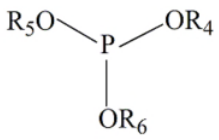
$$MgX^1_2 \qquad (1),$$

wherein X^1 is a halogen, preferably chlorine, bromine or iodine, preferably the magnesium halide is magnesium dichloride; and/or

the organic phosphorus compound is one or more of the compounds represented by formula (2) or formula (3):



(2)



(3)

wherein R_1, R_2, R_3, R_4, R_5, R_6 each independently have 1-20 carbon atoms and are selected from the group consisting of linear or branched alkyl groups, cycloalkyl groups, aromatic hydrocarbon groups, and aromatic hydrocarbon groups having a substituent, preferably the organic phosphorus compound is one or more of trimethyl phosphate, triethyl phosphate, tributyl phosphate, tripentyl phosphate, triphenyl phosphate, trimethyl phosphite, triethyl phosphite, tributyl phosphite and tribenzyl phosphite; and/or

the organic solvent is one or more of toluene, ethylbenzene, benzene, xylenes and chlorobenzene, and more preferably the organic solvent is used in an amount of from 1 to 40 moles, and preferably from 2 to 30 moles, relative to one mole of the magnesium halide.

6. The method as claimed in any one of claims 4 to 5, characterized in that, in step S2, the inert dispersion medium is one or more of white oils, hexanes and decanes, and more preferably the inert dispersion medium is used in an amount of from 0.1 g to 300 g, preferably from 1 g to 150 g, relative to one gram of the magnesium halide; and/or

the Lewis acid comprises a titanium-containing compound represented by general formula (4):

$$TiX^2_m(OR^1)_{4-m} \qquad (4)$$

wherein X^2 is a halogen, preferably chlorine, bromine or iodine, R^1 is a hydrocarbon group having 1-20 carbon atoms, and m is an integer of 1 to 4, preferably the titanium-containing compound is one or more of titanium tetrachloride, titanium tetrabromide, titanium tetraiodide, titanium tetrabutoxide, titanium tetraethoxide, triethoxy titanium chloride, diethoxy titanium dichloride and ethoxy titanium trichloride, and more preferably the titanium-containing compound is used in an

amount of from 0.5 to 25 moles, preferably from 1 to 20 moles, relative to one mole of the magnesium halide.

7. The method as claimed in any one of claims 4 to 6, characterized in that, in step S3, the auxiliary precipitant is one or more selected from the group consisting of organic acids, organic acid anhydrides, organic ethers and organic ketones, preferably the auxiliary precipitant is one or more selected from the group consisting of acetic anhydride, phthalic anhydride, succinic anhydride, maleic anhydride, pyromellitic dianhydride, acetic acid, propionic acid, butyric acid, acrylic acid, methacrylic acid, acetone, methyl ethyl ketone, benzophenone, dimethyl ether, diethyl ether, dipropyl ether, dibutyl ether and dipentyl ether, and more preferably the auxiliary precipitant is used in an amount of from 0.01 to 1 mole, preferably from 0.04 to 0.4 moles, relative to one mole of the magnesium halide; and/or

the surfactant is a polymeric surfactant, preferably the surfactant is one or more selected from the group consisting of alkyl (meth)acrylate polymers, alkyl (meth)acrylate copolymers, alcoholysates of maleic anhydride polymers, and alcoholysates of maleic anhydride copolymers, and more preferably the surfactant is used in an amount of from 0.01 g to 5 g, preferably from 0.05 g to 1 g, relative to one gram of the magnesium halide.

8. A solid catalyst component for olefin polymerization with a multimodal pore distribution, which comprises the magnesium-based solid as claimed in claims 1 to 7 and at least one internal electron donor.

9. The solid catalyst component as claimed in claim 8, characterized in that, as measured by nitrogen adsorption method, the solid catalyst component has a pore size distribution exhibiting multiple peaks and a specific surface area of not less than 50 m^2/g; wherein the pore size distribution exhibiting multiple peaks of the solid is such that there are at least a first peak in the pore size range of 1 nm-10 nm and at least a second peak in the pore size range of 10 nm-200 nm.

10. The solid catalyst component as claimed in claim 8 or 9, characterized in that, the pore size distribution exhibiting multiple peaks of the solid is such that the peak in the pore size range of 1 nm-10 nm has a most probable pore size of from 2 nm to 8 nm, and further preferably from 2 nm to 6 nm; and the peak in the pore size range of 10 nm-200 nm has a most probable pore size of from 15 nm to 200 nm, preferably from 20 nm to 100 nm, and more preferably from 30 nm to 90 nm.

11. The solid catalyst component as claimed in claims 8 to 10, characterized in that, the pore volume of pores with a pore size of less than 5 nm accounts for 10% to 90%, preferably 15% to 70% of the total pore volume; and the pore volume of pores with a pore size of not less than 30 nm accounts for 5% to 70%, preferably 10% to 60% of the total pore volume.

12. The solid catalyst component as claimed in claim 8, wherein the internal electron donor

is one or more selected from the group consisting of esters, ethers, ketones, amines, and silanes, preferably at least one of aliphatic mono- or poly-carboxylic acid esters, aromatic carboxylic acid esters, diol ester compounds and diether compounds, and preferably includes at least one of dibasic aliphatic carboxylic acid esters, aromatic carboxylic acid esters, diol esters and diether compounds, and more preferably includes at least one of phthalates, malonates, succinates, glutarates, diol esters, diethers, neovalerates and carbonates.

13. A method for preparing the solid catalyst component for olefin polymerization as claimed in any one of claims 8 to 12, comprising adding at least one internal electron donor during the preparation of the magnesium-based solid; or/and contacting at least one internal electron donor with the magnesium-based solid, to obtain the solid catalyst component for olefin polymerization.

14. A catalyst system for olefin polymerization, comprising

(1) the solid catalyst component as claimed in any one of claims 8 to 12;

(2) an alkyl aluminum compound; and

(3) optionally, an external electron donor.

15. Use of the solid catalyst component as claimed in any one of claims 8 to 12 or the catalyst system as claimed in claim 14 in olefin polymerization, especially in propylene polymerization.