opening is formed by removing any one of surfaces of the SiC film with an arbitrary area. The Si substrate is etched through the substrate opening with the SiC film as a mask. When etching the Si substrate, a mixed solution of hydrofluoric acid and nitric acid is used.

[0006] Patent Document 2 below discloses a technique for manufacturing an X-ray mask containing a SiC film. In this technique, a SiC film of 2 micrometer thickness is formed on Si wafer, and a protective film and an X-ray absorbing film are formed on the SiC film. An etching resistant material is applied in a ring shape on the lower surface of the Si wafer, and the central part of the Si wafer is removed using an aqueous solution of sodium hydroxide.

[0007] Patent Document 3 below discloses a technique in which a 3C-SiC layer is formed on one side of a Si substrate containing a reinforcing member. The Si substrate is dissolved with an etching solution mixed with hydrofluoric acid, nitric acid or the like.

PRIOR ART DOCUMENT

DOCUMENT(S) RELATED TO PATENTS

[0008]

Patent Document 1: Japanese Patent Application Laid-open No. (HEI) 09-310170

Patent Document 2: Japanese Patent Application Laid-Open No. (HEI) 07-118854

Patent Document 3: Japanese Patent Application Laid-Open No. 2015-202990

SUMMARY

PROBLEMS TO BE RESOLVED BY THE INVENTION

[0009] As a compound semiconductor substrate with a SiC film, the SiC film is required to thin the film. For example, in the case of MEMS using a SiC film, film thinning of the SiC film is required, from the viewpoint of sensitivity improvement. In the case of a pellicle using a SiC film, film thinning of the SiC film is required, from the viewpoint of further improvement of optical transparency.

[0010] However, according to the conventional techniques, it was impossible to form a compound semiconductor substrate provided with a thinned SiC film. When attempting to thin the SiC film (for example, to make it to a thickness of 10 micrometer or less), the

mechanical strength becomes lower as compared with the case where the SiC film is thick. For this reason, cracks were generated in the SiC film during etching of the Si substrate, and a phenomenon in which the SiC film is peeled off from the Si substrate occurred.

[0011] The present invention is intended to solve the above problems, and the object is to provide a compound semiconductor substrate, a pellicle film, and a method for manufacturing a compound semiconductor substrate capable of film thinning of the SiC film.

MEANS FOR SOLVING THE PROBLEM

[0012] According to one aspect of the present disclosure, a compound semiconductor substrate comprises: a Si substrate having a ring-like planar shape, and a SiC film having a thickness of 20 nanometers or more and 10 micrometers or less, formed on one principal surface side of the Si substrate, wherein the SiC film is not formed on another principal surface side of the Si substrate.

[0013] In an example, according to the compound semiconductor substrate, width of the Si substrate decreases with distance from the SiC film, when viewed in a cross section cut along a plane perpendicular to a surface of the SiC film.

[0014] In an example, the compound semiconductor substrate further comprises a film different from SiC, formed on one principal surface of the SiC film.

[0015] In an example, according to the compound semiconductor substrate, the film different from SiC is made of graphene, graphite, or GaN (gallium nitride).

[0016] In an example, according to the compound semiconductor substrate, the SiC film is formed on the one principal surface of the Si substrate.

[0017] In an example, the compound semiconductor substrate further comprises a Si oxide film formed on the one principal surface of the Si substrate, wherein the SiC film is formed on the one principal surface side of the Si oxide film.

[0018] According to another aspect of the present disclosure, a pellicle film uses the compound semiconductor substrate described above.

[0019] According to still another aspect of the present disclosure, a method for manufacturing a compound semiconductor substrate comprises a step of forming a SiC film on one principal surface side of a Si substrate, and a step of exposing at least a part of

a principal surface of the SiC film on the Si substrate side by wet etching, wherein in the step of exposing at least a part of a principal surface of the SiC film on the Si substrate side, at least the Si substrate and the SiC film are relatively moved with respect to the liquid chemical used for the wet etching.

[0020] In an example, according to the method for manufacturing a compound semiconductor substrate, in the step of exposing at least a part of a principal surface of the SiC film on the Si substrate side, at least the Si substrate and the SiC film are moved in a direction in a plane parallel to the one principal surface of the SiC film.

[0021] In an example, according to the method for manufacturing a compound semiconductor substrate, in the step of exposing at least a part of a principal surface of the SiC film on the Si substrate side, at least the Si substrate and the SiC film being rotated, a liquid chemical used for the wet etching is injected into the another principal surface of the Si substrate.

[0022] In an example, the method for manufacturing a compound semiconductor substrate comprises a step of forming a recessed part in which a bottom surface is Si in a central part of the another principal surface of the Si substrate, wherein in the step of exposing at least a part of a principal surface of the SiC film on the Si substrate side, the SiC film is exposed on the bottom surface of the recessed part.

[0023] In an example, according to the method for manufacturing a compound semiconductor substrate, the step of forming the SiC film is performed after the step of forming the recessed part in the central part of the another principal surface of the Si substrate.

[0024] In an example, according to the method for manufacturing a compound semiconductor substrate, the step of forming the recessed part in the central part of the another principal surface of the Si substrate is performed after the step of forming the SiC film.

[0025] In an example, according to the method for manufacturing a compound semiconductor substrate, the central part of the another principal surface of the Si substrate is removed by wet etching, using a mask layer made of an oxide film or a nitride film formed on the another principal surface of the Si substrate as a mask, in the

step of forming the recessed part in the central part of the another principal surface of the Si

substrate.

[0026] In an example, according to the method for manufacturing a compound semiconductor substrate, the SiC film is formed on the one principal surface side and a side surface of the Si substrate and on a peripheral part of the another principal surface of the Si substrate, in the step of forming the SiC film, and the another principal surface of the Si substrate is removed, using the SiC film formed on the peripheral part of the another principal surface of the Si substrate as a mask, in the step of exposing at least a part of the principal surface of the SiC film on the Si substrate side.

[0027] In an example, according to the method for manufacturing a compound semiconductor substrate, a mixed acid containing hydrofluoric acid and nitric acid is used as the liquid chemical used for the wet etching, in the step of exposing at least a part of a principal surface of the SiC film on the Si substrate side.

[0028] In an example, the method for manufacturing a compound semiconductor substrate further comprises a step of forming a GaN film on a principal surface of the SiC film opposite to the Si substrate side, after the step of exposing at least a part of a principal surface of the SiC film on the Si substrate side.

[0029] In an example, the method for manufacturing a compound semiconductor substrate further comprises a step of change a part of the SiC film to a graphene film or a graphite film.

[0030] In an example, the method for manufacturing a compound semiconductor substrate further comprises a step of forming a graphene film or a graphite film laminated on a principal surface of the SiC film opposite to the Si substrate side.

[0031] In an example, according to the method for manufacturing a compound semiconductor substrate, the SiC film is formed on the one principal surface of the Si substrate in the step of forming the SiC film.

[0032] In an example, the method for manufacturing a compound semiconductor substrate further comprises a step of forming a Si oxide film on the one principal surface of the Si substrate, wherein the SiC film is formed on one principal surface side of the Si oxide film, in the step of forming the SiC film.

EFFECT OF THE INVENTION