WHAT IS CLAIMED IS:

1. A SiC wafer producing method for producing a SiC wafer from a single crystal SiC ingot, said SiC wafer producing method comprising:

a separation layer forming step of setting a focal point of a pulsed laser beam having a transmission wavelength to said single crystal SiC ingot inside said single crystal SiC ingot at a predetermined depth from a flat surface of said single crystal SiC ingot, said predetermined depth corresponding to a thickness of said SiC wafer to be produced, and next applying said pulsed laser beam to said single crystal SiC ingot to thereby form a separation layer for separating said SiC wafer from said single crystal SiC ingot;

a wafer separating step of separating said SiC wafer from said single crystal SiC ingot along said separation layer after performing said separation layer forming step;

a flat surface forming step of grinding an upper surface of said single crystal SiC ingot as a rough separation surface left after separating said SiC wafer in said wafer separating step, thereby removing the roughness of said upper surface of said single crystal SiC ingot to flatten said upper surface of said single

crystal SiC ingot;

said flat surface forming step including

a first grinding step of performing grinding to said upper surface of said single crystal SiC ingot to thereby partially remove the roughness of said upper surface of said single crystal SiC ingot, and

a second grinding step of performing finer grinding than said first grinding step to said upper surface of said single crystal SiC ingot after performing said first grinding step, thereby completely removing the roughness of said upper surface of said single crystal SiC ingot to flatten said upper surface of said single crystal SiC ingot; and wherein

before said separation layer forming step, said single crystal SiC ingot has a first surface as said flat surface, a second surface opposite to said first surface, a c-axis extending from said first surface to said second surface, and a c-plane perpendicular to said c-axis, said c-axis being inclined by an off angle with respect to a normal to said first surface, said off angle being formed between said c-plane and said first surface; and wherein

said separation layer forming step includes:

a modified layer forming step of setting the focal point of said pulsed laser beam inside said single

crystal SiC ingot at said predetermined depth from said first surface, and next applying said pulsed laser beam to said single crystal SiC ingot as relatively moving said single crystal SiC ingot and said focal point in a first direction perpendicular to a second direction where said off angle is formed, thereby forming a linear modified layer inside said single crystal SiC ingot at said predetermined depth so as to extend in said first direction and cracks extending from said modified layer in opposite directions along said c-plane, said modified layer being formed such that SiC is decomposed into Si and C by said pulsed laser beam first applied, and said pulsed laser beam next applied is absorbed by C previously produced to continue the decomposition of SiC into Si and C in a chain reaction manner with the relative movement of said single crystal SiC ingot and said focal point in said first direction, and

an indexing step of relatively moving said single crystal SiC ingot and said focal point in said second direction by a predetermined index amount, said modified layer forming step and said indexing step being repeated plural times to thereby form said separation layer inside said single crystal SiC ingot in the condition where a plurality of linear modified layers are

arranged at given intervals in said second direction so as to be connected through said cracks.

2. The SiC wafer producing method according to claim 1, wherein

70% to 90% of the roughness of said upper surface of said single crystal SiC ingot is ground in said first grinding step, and

the remaining roughness of said upper surface of said single crystal SiC ingot after said first grinding step is completed is completely ground in said second grinding step.

3. The SiC wafer producing method according to claim 2,

wherein said first grinding step or said second grinding step or both, wherein a center of rotation of a grinding wheel is deviated from a center of rotation of a chuck table where said single crystal SiC ingot sits on.

4. The SiC wafer producing method according to claim 3, wherein said grinding wheel and said SiC wafer rotate in the same direction.

5. The SiC wafer producing method according to claim 1,

wherein applying ultrasonic vibration and rotation to a top surface of said SiC wafer comprises:

contacting a rotatable disk-shaped suction member with said top surface;

applying ultrasonic vibration to said rotatable disk-shaped suction member; and

rotating said rotatable disk-shaped suction member.