includes the fact that it was not possible to produce semiconductor wafers which were free of defects or which exhibited a defect profile that is uniform over the diameter.

Embodiments~~The object~~ of the present invention seek~~is~~ to demonstrate what has to be effected in order that it is possible to produce semiconductor wafers composed of silicon in high yields and with economic pulling rates, which semiconductor wafers exhibit a diameter of at least 450 mm and a defect profile that is uniform over the diameter.

According to an aspect of the invention, there is provided~~The object is achieved by means of~~ a method for producing semiconductor wafers composed of silicon, comprising
pulling a single crystal with a conical section having an increasing diameter and an adjoining cylindrical section having a diameter of at least 450 mm and a length of at least 800 mm from a melt contained in a crucible, at a pulling rate which, in the course of pulling the transition from the conical section to the cylindrical section, is at least 1.8 times higher than the average pulling rate during the pulling of the cylindrical section;
cooling the growing single crystal with a cooling power of at least 20 kW, a van Mises stress by the cooling being not more than 35 MPa;
feeding heat from the side wall of the crucible to the growing single crystal, wherein a gap having a height of at least 70 mm is present between a heat shield surrounding the growing single crystal and the surface of the melt; and
slicing semiconductor wafers from the cylindrical section, wherein a plurality of the semiconductor wafers have a region with v-defects that extends from the center of the semiconductor wafers as far as the edge of the semiconductor wafers.

The plurality of the semiconductor wafers having a diameter of at least 450 mm that are produced with the aid of the method are distinguished by a defect region with v-defects that

Patent claims

1. A method for producing semiconductor wafers composed of silicon, comprising
pulling a single crystal with a conical section having an increasing diameter and an adjoining cylindrical section having a diameter of at least 450 mm and a length of at least 800 mm from a melt contained in a crucible, at a pulling rate which, in the course of pulling the transition from the conical section to the cylindrical section, is at least 1.8 times higher than the average pulling rate during the pulling of the cylindrical section;
cooling the growing single crystal with a cooling power of at least 20 kW, a van Mises stress by the cooling being not more than 35 MPa;
feeding heat from the side wall of the crucible to the growing single crystal, wherein a gap having a height of at least 70 mm is present between a heat shield surrounding the growing single crystal and the surface of the melt; and
slicing semiconductor wafers from the cylindrical section, wherein a plurality of the semiconductor wafers have a region with v-defects that extends from the center of the semiconductor wafers as far as the edge of the semiconductor wafers.

2. The method as claimed in claim 1, wherein the single crystal is pulled at an average pulling rate of not less than 0.5 mm/min during the pulling of the cylindrical section.

~~3. A semiconductor wafer composed of silicon, which has a diameter of 450 mm and a region with v-defects that extends from the center of the semiconductor wafer as far as the edge of the semiconductor wafer.~~

~~4. The semiconductor wafer as claimed in claim 3, characterized by an average density of OSF defects of not more than 6 cm^{-2}.~~

~~5. The semiconductor wafer as claimed in claim 3 or claim 4, characterized by a radial variation of the resistivity of not more than 10%.~~

~~6. The semiconductor wafer as claimed in any of claims 3 to 5, characterized by a radial variation of the oxygen concentration of not more than 12%.~~

~~7. The semiconductor wafer as claimed in any of claims 3 to 6, characterized by an epitaxial coating.~~