through the surface of the solidified silicon melt, and the silicon melt in the crucible may be splashed, possibly stopping the production of the ingot. For this reason, in the conventional recharge method, large chunks of polycrystalline silicon cannot be dropped. Large chunks of raw material polycrystalline silicon have the advantage that they can be produced at low cost and that therefore the production costs can be reduced. Further, in the case when large chunks of raw material polycrystalline silicon are used, the total surface area of the raw material polycrystalline silicon is smaller at the same weight than in the case when small chunks of polycrystalline silicon are used. As a result, SiO_2 on the surface of the polycrystalline silicon, impurities such as metals, and the mixing-in of atmospheric gases, etc. can be reduced. Thus, in the case of using the large chunks of the raw material polycrystalline silicon, in the grown ingot, the decline of the dislocation free rate and the quality because of contamination by impurities, formation of pinholes, etc. can be restricted.

Moreover, in the conventional recharge method, the surface of the silicon melt in the crucible is solidified. Therefore, the volume is expanded at the surface of the silicon melt and a force compressing the inner wall of the crucible is generated. This force is likely to rupture the crucible.

Embodiments~~The object~~ of the present invention seek~~is~~ to provide a method for recharging raw material polycrystalline silicon, which enables large chunks of polycrystalline silicon to be recharged while preventing the crucible from being damaged and ruptured as well as restricting the decline of the dislocation free rate and the quality of the grown ingot.

~~In order to achieve the above object, the method for recharging raw material polycrystalline silicon is as fol-~~

~~lows.~~

According to an aspect of the present invention, there is provided a method for recharging raw material polycrystalline silicon in a method for producing a silicon single crystal ingot comprising a filling step of filling raw material polycrystalline silicon into a crucible, a melting step of melting the filled polycrystalline silicon in the crucible into silicon melt, and a pulling-up step of bringing a seed crystal into contact with the silicon melt and pulling up the seed crystal to thereby grow a silicon single crystal ingot; in which the raw material polycrystalline silicon is supplied into the crucible after the melting step and the pulling-up step; wherein a cushioning region is formed on a surface of the silicon melt in the crucible, and the raw material polycrystalline silicon is supplied onto the formed cushioning region, and the cushioning region is formed by introducing polycrystalline silicon chunks having sizes of 5 mm to 50 mm to the surface of the silicon melt in the crucible, and the raw material polycrystalline silicon supplied onto the cushioning region consist of polycrystalline silicon chunks having sizes of more than 50 mm.

According to an embodiment of the invention, ~~It is~~ a method for recharging raw material polycrystalline silicon in a method for producing a silicon single crystal ingot comprising a filling step of filling raw material polycrystalline silicon into a crucible, a melting step of melting the filled polycrystalline silicon in the crucible to form a silicon melt, and a pulling-up step of bringing a seed crystal into contact with the silicon melt and pulling up the seed crystal to thereby grow a silicon single crystal ingot; in which further raw material polycrystalline sili-

con is supplied into the crucible after the melting step and the pulling-up step; wherein a cushioning region is formed by introducing small polycrystalline silicon chunks having small sizes to the surface of the silicon melt in the crucible, and large polycrystalline silicon chunks being larger in size than the small polycrystalline silicon chunks are supplied onto the cushioning region.

~~In the method for recharging raw material polycrystalline silicon according to the present invention, the small polycrystalline silicon chunks have sizes of 5 mm to 50 mm.~~

~~In the method for recharging raw material polycrystalline silicon according to the present invention,~~ Tthe small polycrystalline silicon chunks may have sizes from 5 mm to less than 20 mm.

~~In the method for recharging raw material polycrystalline silicon according to the present invention,~~ Tthe small polycrystalline silicon chunks may have sizes of 20 mm to 50 mm.

~~In the method for recharging raw material polycrystalline silicon according to the present invention,~~ Aa recharge device comprising a main body having a passageway running through it and a lid body enabling one end of the main body to be opened and closed, is used to supply the raw material

polycrystalline silicon to the silicon melt in the crucible.

~~In the method for recharging raw material polycrystalline silicon according to the present invention,~~ Tthe large polycrystalline silicon chunks have sizes which allow the large polycrystalline silicon chunks to pass through the passageway of the main body, and which are larger than 50 mm.

~~In the method for recharging raw material polycrystalline silicon according to the present invention,~~ Tthe one end of the main body of the recharge device is closed by the lid body, the small polycrystalline silicon chunks are filled into the main body, the large polycrystalline silicon chunks are filled onto the small polycrystalline silicon chunks filled into the main body, and the lid body is opened to supply the raw material polycrystalline silicon to the silicon melt in the crucible.

Effect of the Invention

According to the method for raw material recharging polycrystalline silicon according to the present invention, even when the large chunks of raw material polycrystalline silicon are recharged, the cushioning region formed on the surface of the silicon melt in the crucible functions as an impact cushioning member, whereby it is capable of preventing the silicon melt in the crucible from being splashed and of preventing the crucible from being damaged or ruptured. Further, the large chunks of polycrystalline silicon can be recharged without splashing the silicon melt, and this makes it possible to prevent the dislocation free rate and the quality of the grown ingot from declining. Moreover, since the large chunks of raw material polycrystalline silicon can be produced at low cost, the advantage can

Claims:

1. A method for recharging raw material polycrystalline silicon in a method for producing a silicon single crystal ingot comprising a filling step of filling raw material polycrystalline silicon into a crucible, a melting step of melting the filled polycrystalline silicon in the crucible into silicon melt, and a pulling-up step of bringing a seed crystal into contact with the silicon melt and pulling up the seed crystal to thereby grow a silicon single crystal ingot; in which the raw material polycrystalline silicon is supplied into the crucible after the melting step and the pulling-up step; wherein a cushioning region is formed on a surface of the silicon melt in the crucible, and the raw material polycrystalline silicon is supplied onto the formed cushioning region, and
the cushioning region is formed by introducing polycrystalline silicon chunks having sizes of 5 mm to 50 mm to the surface of the silicon melt in the crucible, and the raw material polycrystalline silicon supplied onto the cushioning region consist of polycrystalline silicon chunks having sizes of more than 50 mm.

2. A method for recharging raw material polycrystalline silicon according to Claim 1, wherein the polycrystalline silicon chunks forming the cushioning region have sizes from 5 mm to less than 20 mm.

3. A method for recharging raw material polycrystalline silicon according to Claim 1, wherein the polycrystalline silicon chunks forming the cushioning region have sizes of 20 mm to 50 mm.

4. A method for recharging raw material polycrystalline silicon according to one of Claims 1 - 3, wherein a recharge device comprising a main body having a passageway running through it and a lid body enabling one end of the main body to be opened and closed, is used to supply the raw material polycrystalline silicon to the silicon melt in the crucible.

5. A method for recharging raw material polycrystalline silicon according to Claim 4, wherein the polycrystalline silicon chunks having sizes of more than 50 mm can pass through the passageway of the main body.

6. A method for recharging raw material polycrystalline silicon according to Claim 4 or Claim 5, wherein the one end of the main body of the recharge device is closed by the lid body, the polycrystalline silicon chunks having sizes of 5 mm to 50 mm are filled into the main body, the polycrystalline silicon chunks having sizes of more than 50 mm are filled onto the polycrystalline silicon chunks having sizes of 5 mm to 50 mm, and the lid body is opened to supply the raw material polycrystalline silicon to the silicon melt in the crucible.

Claims:

1. A method for recharging raw material polycrystalline silicon for producing a silicon single crystal ingot comprising a filling step of filling raw material polycrystalline silicon into a crucible, a melting step of melting the filled polycrystalline silicon in the crucible to form a silicon melt, and a pulling-up step of bringing a seed crystal into contact with the silicon melt and pulling up the seed crystal to thereby grow a silicon single crystal ingot; in which further raw material polycrystalline silicon is supplied into the crucible after the melting step and the pulling-up step; wherein a cushioning region is formed by introducing small polycrystalline silicon chunks having small sizes to the surface of the silicon melt in the crucible, and large polycrystalline silicon chunks being larger in size than the small polycrystalline silicon chunks are supplied onto the cushioning region.

2. A method for recharging raw material polycrystalline silicon according to Claim 1, wherein the small polycrystalline silicon chunks have sizes of 5 mm to 50 mm.

3. A method for recharging raw material polycrystalline silicon according to Claim 2, wherein the small polycrystalline silicon chunks have sizes from 5 mm to less than 20 mm.

4. A method for recharging raw material polycrystalline silicon according to Claim 2, wherein the small polycrystalline silicon chunks have sizes of 20 mm to 50 mm.

5. A method for recharging raw material polycrystalline silicon according to one of Claims 1 - 4, wherein a recharge device comprising a main body having a passageway running through it and a lid body enabling one end of the

main body to be opened and closed, is used to supply the raw material polycrystalline silicon to the silicon melt in the crucible.

6. A method for recharging raw material polycrystalline silicon according to Claim 5, wherein the large polycrystalline silicon chunks have sizes which allow the large polycrystalline silicon chunks to pass through the passageway of the main body, and which are larger than 50 mm.

7. A method for recharging raw material polycrystalline silicon according to Claim 5 or 6, wherein the one end of the main body of the recharge device is closed by the lid body, the small polycrystalline silicon chunks are filled into the main body, the large polycrystalline silicon chunks are filled onto the small polycrystalline silicon chunks filled into the main body, and the lid body is opened to supply the raw material polycrystalline silicon to the silicon melt in the crucible.