Patent Claims

1. A method for determining a diameter (d_K) of a single crystal (200) during the pulling of a cylindrical section (205) of the single crystal (200) and of an end cone (210) of the single crystal (200), from a melt (230) in a crucible (130) of a device (100) for pulling the single crystal (200),

wherein the diameter (d_K) of the single crystal (200) at an interface with the melt (230) is determined while taking into account

a first lowering rate (v_S) of a surface (235) of the melt (230) relative to the crucible (130),

a first lifting rate (v_K), with which the single crystal (200) is raised relative to the crucible (130), and

a conservation of mass,

wherein a diameter of the single crystal (200), determined during the pulling of a cylindrical section (205) of the single crystal (200) by means of observing a bright ring on the surface (235) of the melt (230), is used for a correction, a plausibility check or a comparison of the diameter (d_K) of the single crystal (200), which is to be determined during the pulling of the end cone (210) of the single crystal, and wherein

either a variation of a height, a shape, or both of a boundary region (240) between the melt (230) and the solid single crystal (200) is taken into account during the determination of the diameter (d_K) of the single crystal (200) by means of a correction factor in a transition region between a cylindrical section (205) of the single crystal (200) and the end cone (210)

or the determination of the diameter of the single crystal is interrupted in a transition region between a cylindrical section (205) of the single crystal (200) and the end cone (210), when a predetermined variation of a height, a shape, or both of a boundary region (240) between the melt (230) and the solid single crystal (200) occurs.

2. The method as claimed in claim 1, wherein a second lowering rate (v^*_S) of the surface (235) of the melt (230) relative to the device (100), and a rate (v^*_T) with which the position of the crucible (130) relative to the device (100) is varied, are determined in order to take into account the first lowering rate (v_S) of the surface (235) of the melt (230) relative to the crucible (130).

3. The method as claimed in claim 2, wherein a rotation of the crucible (130) and its variation are taken into account during the determination of the second lowering rate (v^*_S).

4. The method as claimed in one of the preceding claims, wherein a second lifting rate (v^*_K), with which the single crystal (200) is raised relative to the device (100), and a rate (v^*_T) with which the position of the crucible (130) relative to the device (100) is varied, are determined in order to take into account the first lifting rate (v_K), with which the single crystal (200) is raised relative to the crucible (130).

5. The method as claimed in one of claims 1 to 3, wherein a density difference between liquid and solid material of the melt (230), or of the single crystal (200), is taken into account during the determination of the diameter (d_K) of the single crystal (200).

6. The method as claimed in one of claims 1 to 3, wherein the diameter of the crucible (130) at the position of the surface of the melt is taken into account during the determination of the diameter (d_K) of the single crystal (200).

7. The method as claimed in one of claims 1 to 3, wherein a diameter (d_T) of the crucible (130) is taken into account during the determination of the diameter (d_K) of the single crystal (200) during the pulling of the end cone (210) of the single crystal (200), and the accuracy of the determination of the diameter (d_K) of the single crystal (200) is increased by correcting the diameter (d_T) of the crucible (130) by a constant offset.

8. The method as claimed in one of claims 1 to 3, wherein noise suppression is carried out during the determination of the diameter (d_K) of the single crystal (200).

9. The method as claimed in one of claims 1 to 3, wherein the diameter (d_K) of the single crystal (200) which is found is used as a variable to be regulated during the pulling of the single crystal (200).

10. The method as claimed in claim 4, wherein one or more of the first lifting rate (v_K) and the second lifting rate (v^*_K) of the single crystal (200), a rate (v_T) with which the position of the crucible (130) is varied, one or more powers and temperatures of the device (100), and a rotation rate of the single crystal (200) and of the crucible (130) are used as manipulated variables during the pulling of the single crystal (200).