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METHOD OF PRODUCING SILICON SINGLE CRYSTALS

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3,031,270 METHOD OF PRODUCING SILICON SINGLE CRYSTALS

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This invention is concerned with a method of producing silicon single crystals. The production of such single crystals causes considerable and well recognized difficulties.

In accordance with the invention, silicon single crystals are obtained by providing upon a single crystal silicon seed body layers of atomic silicon and heating each layer at least once up to the melting thereof.

The silicon seed crystal body may be disc-shaped or pin-shaped.

The atomic silicon may be provided upon the seed body by vaporization. It may also be provided by thermal decomposition from gaseous silicon compounds upon the heated seed body. Compounds of $SiHCl_3$ and SiH_4 are particularly suitable for such a procedure.

The atomic silicon can also be produced from gaseous silicon compounds by reaction, using, for example, $SiCl_4$ mixed with hydrogen.

The heating of each layer up to melting thereof can be repeated; single crystal layers of desired thickness can be obtained in this manner.

The heating of the layers up to the melting is according to the invention effected by the application of high frequency fields.

The heating can also be effected by cathode drop pulses. The silicon body is thereby connected, for example, as anode. Intermediate or high frequency discharge pulses are also usable.

It is not necessary that purest silicon be always deposited; it may be silicon intermixed with three- or five-valence elements which upon precipitation produce p- or n-conductive layers. The addition of atomic boron effect a p-doping while n-doping occurs by the addition of arsenic.

The accompanying figure shows a pin-shaped single crystal 1 upon whch are in accordance with the invention deposited a number of layers 2.

Changes may be made within the scope and spirit of the appended claims which define what is believed to be new and desired to have protected by Letters Patent.

I claim:

1. The method of producing single crystal silicon bodies comprising providing upon a single crystal silicon seed body layers of atomic silicon, and heating each layer at least once up to the melting thereof.

2. The method according to claim 1, wherein the seed body is disc-shaped.

3. The method according to claim 1, wherein the seed body is pin-shaped.

4. The method according to claim 1, comprising vaporizing the atomic silicon on said seed body.

5. The method according to claim 1, comprising producing the atomic silicon upon said seed body from gaseous silicon compounds by thermal decomposition of such compounds.

6. The method according to claim 1, comprising producing the atomic silicon by reaction of gaseous silicon compounds.

7. The method according to claim 1, comprising repeatedly heating each layer up to melting thereof.

8. The method according to claim 1, comprising effecting said heating by the action of high frequency fields.

9. The method according to claim 1, comprising effecting said heating by the action of cathode drop pulses.

10. The method according to claim 1, comprising effecting said heating by the action of discharge pulses.

11. The method according to claim 1, comprising providing in addition to said atomic silicon atomically deposited three- or five-valence elements.

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