Method for reducing molten raw materials, and device for carrying out said method

Summary

In one aspect, there is provided method for reducing molten raw materials, in which the raw materials in a solid or molten state are placed on a bed comprising coke pieces, which bed is inductively heated at least partially, and the reduced melt that runs off the coke bed is collected and the waste gases are discharged, characterised in that a coke bed is used that is delimited internally by a pipe-shaped element, with the pipe-shaped element being heated and the reaction gases from the coke bed being discharged via a plurality of exhaust vents formed in the pipe-shaped element and that a reducing agent is blown or suctioned into the coke bed. In another aspect, there is provided device for reducing molten raw materials, in particular for performing a method according to the present invention, comprising a reactor for receiving a bed of coke pieces and an induction heater comprising at least one induction coil for the induction heating of the coke bed, with the reactor having a feed opening for the solid and molten raw materials and a tap hole for the processed melt, characterised in that the reactor is designed to receive a coke bed with a ring-shaped cross section that is delimited internally by a pipe-shaped reactor element, with the pipe-shaped element being made of a material suitable for inductive coupling with the induction field of the induction coil, in particular graphite, and having a plurality of exhaust vents for discharging the reaction gases from the coke bed, the exhaust vents being arranged running diagonally upwards in the direction of the exhaust duct.

Description

The invention relates to a method for reducing molten raw materials, in which the raw materials in a solid, molten or gaseous state are placed on a bed comprising coke pieces, which bed is inductively heated at least partially, and the reduced melt that runs off the coke bed is collected and the waste gases are discharged. The invention also relates to a device for carrying out this method, comprising a reactor for receiving a bed of coke pieces, and an induction heater comprising at least one induction coil for the induction heating of the coke bed.

The molten raw materials to be reduced are in particular ores, dusts, slags, residues from pyrolysis, gasification and combustion, melts, slurries, ESU (Elektro-Schlacken-Umschmelz [electrical slag remelt]) slag components (such as, e.g. CaO, CaF_2, Al_2O_3) and/or metal oxide glasses as well as mineral melts to be degassed.

Coke pieces in the context of this invention include in particular carbon carriers such as coke, anthracite and graphite. According to the invention said carbon carriers are advantageously mixed

Claims

1. Method for reducing molten raw materials, in which the raw materials in a solid or molten state are placed on a bed comprising coke pieces, which bed is inductively heated at least partially, and the reduced melt that runs off the coke bed is collected and the waste gases are discharged, characterised in that a coke bed is used that is delimited internally by a pipe-shaped element, with the pipe-shaped element being heated and the reaction gases from the coke bed being discharged via a plurality of exhaust vents formed in the pipe-shaped element and that a reducing agent is blown or suctioned into the coke bed.

2. Method according to claim 1, characterised in that the pipe-shaped element is adapted to the geometry of the coke bed.

3. Method according to one or more of the previous claims, characterised in that the pipe-shaped element has a round or rectangular cross-section or a combination of both.

4. Method according to one or more of the previous claims, characterised in that the pipe-shaped element is an electrically conductive, high temperature-resistant body that is gas-permeable and/or provided with bores.

5. Method according to one or more of the previous claims, characterised in that the pipe-shaped element is heated inductively.

6. Method according to one or more of the previous claims, characterised in that the induction heater provided for the induction heating of the coke bed and the pipe-shaped element is operated alternately or simultaneously with alternating current of different frequencies.

7. Method according to claim 6, characterised in that alternating current of at least a first and second frequency is used.

8. Method according to one or more of the previous claims, characterised in that the exhaust vents pass through the wall of the pipe-shaped element and open inside the pipe-shaped element.

9. Device for reducing molten raw materials, in particular for performing a method according to one or more of claims 1 to 8, comprising a reactor for receiving a bed of coke pieces and an induction heater comprising at least one induction coil for the induction heating of the coke bed, with the reactor having a feed opening for the solid and molten raw materials and a tap hole for the processed melt, characterised in that the reactor is designed to receive a coke bed with a ring-shaped cross section that is delimited internally by a pipe-shaped reactor element, with the pipe-shaped element being made of a material suitable for inductive coupling with the induction field of the induction coil, in particular graphite, and having a plurality of exhaust vents for discharging the reaction gases from the coke bed, the exhaust vents being arranged running diagonally upwards in the direction of the exhaust duct.

10. Device according to claim 9, characterised in that the voltage supply of the induction heater comprises at least one frequency inverter or frequency generator with a control unit, with the former suitable for operating the induction heater alternately or simultaneously with alternating current of different frequencies.

11. Device according to claim 10, characterised in that the control unit is designed to operate the induction heater with alternating current of at least a first and second frequency.

12. Device according to one or more of claims 9 to 11, characterised in that the exhaust vents pass through the wall of the pipe-shaped element and open into an exhaust duct arranged or provided on the inside of the pipe-shaped element.

13. Device according to claim 12, characterised in that the exhaust vents have a first area with a first flow cross section and an adjacent second area that has a smaller flow cross section compared to the first area.