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(54) Title: BAINITIC STEEL OF HIGH STRENGTH AND HIGH ELONGATION AND METHOD TO MANUFACTURE SAID BAINITIC STEEL

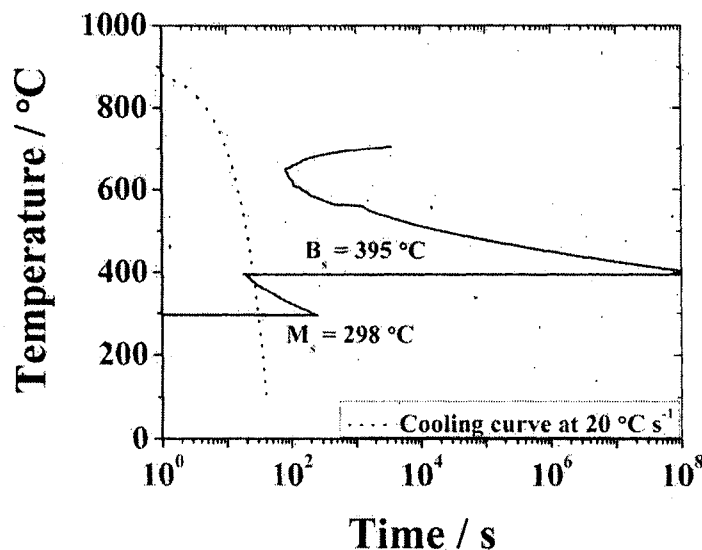


Fig. 1

(57) Abstract: The invention relates to a bainite steel consisting of the following elements in weight %: C: 0.25 - 0.55 Si: 0.5 - 1.8 Mn: 0.8 - 3.8 Cr: 0.2 - 2.0 Ti: 0.0 - 0.1 Cu: 0.0 - 1.2 V: 0.0 - 0.5 Nb: 0.0 - 0.06 Al: 0.0 - 2.75 N: < 0.004 P: < 0.025 S: < 0.025 and a method for manufacturing a bainite steel strip that comprises the step of cooling the coiled strip of such composition to ambient temperature, during which the bainite transformation takes place.



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- *with amended claims (Art. 19(1))*

AMENDED CLAIMS

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CLAIMS

1. Bainite steel consisting of the following elements in weight %:
 C: 0.30 - 0.50
 5 Si: 1.0 - 1.8
 Mn: 1.0 - 2.5
 Cr: 0.7 - 1.5
 Ti: 0.0 - 0.08
 10 Cu: 0.0 - 1.2
 V: 0.0 - 0.5
 Nb: 0.0 - 0.06
 Al: 0.0 - 1.50
 N: < 0.004
 15 P: < 0.025
 S: < 0.025
 the balance being iron and unavoidable impurities.
2. Bainite steel according to claim 1, wherein one or more of the following
 20 elements are present in weight %:
 C: 0.30 - 0.40
 Si: 1.2 - 1.7
 Mn: 1.6 - 2.1
 Cr: 0.9 - 1.2
 25 Ti: 0.0 - 0.07
 Al: 0.0 - 0.2
3. Bainite steel according to one or more of claims 1-2, wherein the steel has a
 hardness of at least 415 VHN.
 30
4. Bainite steel according to one or more of claims 1-3, wherein the steel has a
 ultimate tensile strength of at least 1300 MPa,
5. Bainite steel according to one or more of claims 1-3, wherein the steel has a
 35 ultimate tensile strength of at least 1350 MPa.
6. Bainite steel according to one or more of claims 1-5, wherein the steel has at
 least a total elongation of 20%.

7. Bainite steel according to one or more of claims 1-6, wherein the bainite is carbide-free and with a microstructure with bainite plates with a thickness of less than 100 nm.
- 5 8. Bainite steel according to one or more of claims 1-7, wherein the steel has a microstructure with 15 – 30% of retained austenite.
9. Method for manufacturing a bainite steel consisting of the following elements in weight %:
- 10 C: 0.25 – 0.55
 Si: 0.5 – 1.8
 Mn: 0.8 – 3.8
 Cr: 0.2 – 2.0
 15 Ti: 0.0 – 0.1
 Cu: 0.0 – 1.2
 V: 0.0 – 0.5
 Nb: 0.0 – 0.06
 Al: 0.0 – 2.75
 20 N: < 0.004
 P: < 0.025
 S: < 0.025
- the balance being iron and unavoidable impurities,
 by heat treating the steel to form bainite steel comprising the steps of:
- 25 - hot rolling a cast slab into strip,
 - cooling the strip to a temperature above the bainite start temperature,
 - cooling the strip at a temperature above the bainite start temperature,
 - cooling the coiled strip by natural cooling.
- 30 10. Method according to claim 9, wherein the method further comprises the steps of:
 - preparing liquid steel of the required composition,
 - casting the steel into a slab,
 - cooling the slab.
- 35 11. Method according to claim 10, wherein the cast and cooled slab is reheated to an austenitic state.

12. Method according to one or more of claims 9-11, wherein the final hot rolling temperature is at least 850° C.
13. Method according to one or more of claims 9-12, wherein the hot rolled strip is rapidly cooled to a temperature in the range of 400 - 550° C.
14. Method according to one or more of claims 9-13, wherein the strip is coiled at a strip temperature in the range of 350 - 500° C.
15. Method according to one or more of claims 9-14, wherein the coiled strip is naturally cooled to ambient temperature.
16. Method according to one or more of claims 9-15, wherein one or more of the following elements are present in weight % in the bainite steel:
- C: 0.30 - 0.50
- Si: 1.0 - 1.8
- Mn: 1.0 - 2.5
- Cr: 0.7 - 1.5
- Ti: 0.0 - 0.08
- Al: 0.0 - 1.50
17. Method according to one or more of claims 9-15, wherein one or more of the following elements are present in weight % in the bainite steel:
- C: 0.30 - 0.40
- Si: 1.2 - 1.7
- Mn: 1.6 - 2.1
- Cr: 0.9 - 1.2
- Ti: 0.0 - 0.07
- Al: 0.0 - 0.2