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(54) **Steel excellent in toughness of weld heat-affected zone**

(57) The present invention realizes excellent HAZ toughness by further suppressing the coarsening of austenite grains when they are heated for a long time at a high temperature in order to remarkably improve HAZ properties.

The present invention is a steel excellent in the toughness of a weld heat-affected zone: having a specific chemical composition in mass, of

C: 0.03 to 0.18%,

Si: 0.5% or less,

Mn: 0.4 to 2.0%,

P: 0.02% or less,

S: 0.02% or less,

Al: 0.005 to 0.04%,

Ti: 0.005 to 0.03%,

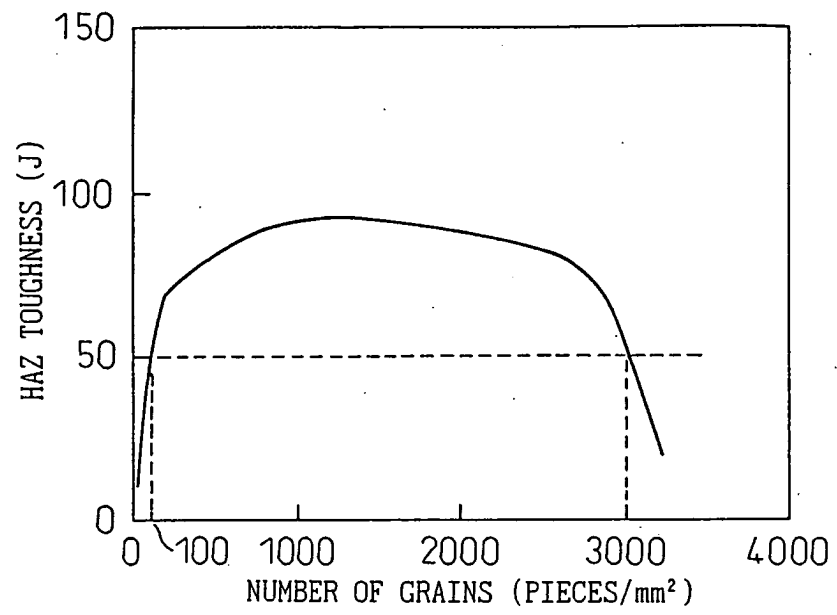
Ca: 0.0005 to 0.003%, and

N: 0.0005 to 0.007%,

with the balance consisting of Fe and unavoidable impurities; satisfying the expression $0 \leq EN \leq 0.002$ regarding the EN value expressed by an equivalent equation comprising (%N), (%Ti) and (%B); and containing oxide particles 0.005 to 2.0 μm , preferably 0.1 to 2.0 μm , in circle-equivalent diameter, which oxide particles contain at least Ca, Al and O in their composition and, in the mass percentage of the elements excluding O, contain Ca at 5% or more and Al at 5% or more with the balance consisting of other deoxidizing elements and/or unavoidable impurities, with the density of the oxide particles being 100 to 3,000 pieces/ mm^2 .

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Fig.1





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EUROPEAN SEARCH REPORT

Application Number
EP 04 02 6201

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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A	PATENT ABSTRACTS OF JAPAN vol. 2000, no. 04, 31 August 2000 (2000-08-31) -& JP 2000 001738 A (NIPPON STEEL CORP), 7 January 2000 (2000-01-07) * abstract * * page 7; example 4; table 1 * -----	1-9	TECHNICAL FIELDS SEARCHED (Int.Cl.7)
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 13 January 2005	Examiner Patton, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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