



(51) International Patent Classification:

C21D 7/02 (2006.01) C22C 38/00 (2006.01)
C21D 7/13 (2006.01) C22C 38/58 (2006.01)

(21) International Application Number:

PCT/TR2015/050010

(22) International Filing Date:

16 June 2015 (16.06.2015)

(25) Filing Language:

English

(26) Publication Language:

English

(30) Priority Data:

2014/06996	16 June 2014 (16.06.2014)	TR
2014/14134	27 November 2014 (27.11.2014)	TR
2015/03030	13 March 2015 (13.03.2015)	TR
2015/07272	12 June 2015 (12.06.2015)	TR

(72) Inventors; and

(71) Applicants : HAYAT, Fatih [TR/TR]; Karabuk Üniversitesi Mühendislik Fakültesi, 78050 Karabuk (TR). SAHIN, Sadettin [TR/TR]; Kirikkale Üniversitesi Mühendislik Fakültesi Yenisehir, 71450 Kirikkale (TR).

(74) Agent: MEZON PATENT DAN. MUH. SAN. CE TIC. LTD. ŞTİ.; Ahmet Taner Kislali Mah. 2778, Sok. No:3/3 Cankaya, 06600 Ankara (TR).

(81) Designated States (unless otherwise indicated, for every

kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every

kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— of inventorship (Rule 4.17(iv))

Published:

— with international search report (Art. 21(3))

(54) Title: STEEL WITH SUPERIOR DUCTILITY AND HIGH STRENGTH AND ITS MANUFACTURING METHOD

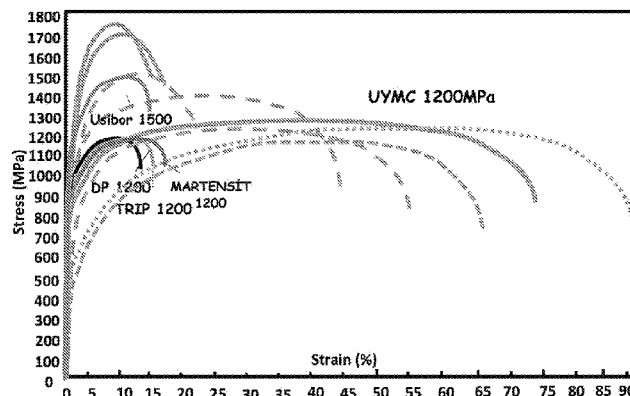


Figure 5

(57) Abstract: This invention relates to a steel (UHSS: Ultra high strength steel) with superior ductility and high strength and method of manufacturing of this low and medium manganese alloyed TRIP (Transformation induced plasticity) / TWIP (Twinning-Induced Plasticity) steel. The method as the subject matter of the invention comprises obtaining high boron and Nickel alloyed TRIP/TWIP steel having high hardness, high strength together with high elongation values by casting and processes after the casting. Commercial TRIP steel is in the HSS class and has lowest manganese ratio (1,2% - 2,8% manganese). TWIP steel is in the UHSS (Ultra High Strength Steel) class and it has been stated as a high manganese ratio steel (18% - 33% manganese) in literature. The most important differentia of this method and the steel that will be produced is having lower or medium manganese ratio and higher boron-nickel ratio. This method includes manufacturing of TWIP steel with low cost and having lower manganese ratio.



DESCRIPTION**STEEL WITH SUPERIOR DUCTILITY AND HIGH STRENGTH AND ITS MANUFACTURING METHOD****5 Technical Field**

This invention relates to a steel (UHSS: Ultra high strength steel) with superior ductility, high strength and high hardness values and the method of manufacturing of this low and medium manganese steel.

10 Prior Art

Throughout history of mankind, working on metal has required quite an effort and processing of some metals have changed different eras. Basically, the characteristics of metals determine the main characteristics of the ages they define (Copper Age, Bronze Age, Iron Age, etc.). In the sectors wherein metals are used, it is required that metals have some different characteristic values such as strength, elongation, flexing etc. Alloys are produced by making a homogeneous mixture of a metal with another element or elements at high temperatures, in order to provide metals having different characteristics. For instance, steel alloys containing chromium element can gain corrosion resistant qualification owing to the chromium element.

20 Steel is one of the alloys which is produced based on iron element. Different elements can be mixed into iron element, thus desired mechanical properties can be obtained by mixing different elements. Some of these basic properties can be considered as hardness, tensile strength, toughness, ductility and magnetism. Besides the addition of alloy elements, mechanical properties of steel can be improved with heat treatment methods at will. The heat treatment is one of the important specializations in steel industry and is taught as a course at the departments such as Metallurgy and Material Engineering. One of two steels having the same chemical composition can be produced as hard while other steel may be relatively soft.

One of the steel alloys disclosed is TRIP (Transformation induced plasticity) / TWIP (Twinning-Induced Plasticity) steel. In the formation of TWIP steel, two different crystals within the crystal structure share a common crystal lattice point, thus increasing the stability of the alloy. TWIP steels contain Manganese (Mn), silicium (Si) and Aluminium (Al) elements as well as iron. Manganese and Aluminium are important elements for preserving the austenitic structure based on the ternary system of iron, manganese and aluminium (Fe-Mn-Al).

TWIP steels are produced with high percentage of manganese so they have relatively high stiffness and ductility values. Therefore, high-Mn TWIP steels are especially useful for automotive applications due to their high energy absorption, which is more than twice that of conventional high strength steels and high stiffness which can improve the crash safety.

The production of TWIP steel with different composition of elements is possible. The addition of different elements to alloy during the production provides TWIP steel to gain properties of these elements or changes can be made in basic properties of TWIP steel according to the industry.

In patent document WO2012052689, the invention relates to a hot-rolled or cold-rolled steel plate, characterised in that the composition thereof is, in weight percent: Carbon ($0.6 \% \leq C \leq 0.9 \%$); manganese ($17 \% \leq Mn \leq 22 \%$); Aluminium ($0.2 \% \leq Al \leq 0.9 \%$); silicium ($0.2 \% \leq Si \leq 1.1 \%$) with ($0.85 \% \leq Al + Si \leq 1.9 \%$); copper ($1.2 \% \leq Cu \leq 1.9 \%$); sulphur ($S \leq 0.030 \%$); phosphore ($P \leq 0.080 \%$); nitrogen ($N \leq 0.1 \%$); optionally: niobium ($Nb \leq 0.25 \%$), preferably between (0.070 and 0.25 %); vanadium ($V \leq 0.5 \%$), preferably between (0.050 and 0.5 %); titanium ($Ti \leq 0.5 \%$), preferably between (0.040 and 0.5 %); nickel ($Ni \leq 2 \%$); trace elements Chromium ($Cr \leq 2 \%$), preferably ($Cr \leq 1 \%$); boron ($B \leq 0.010 \%$), preferably between (0.0005 % and 0.010 %); the remainder being iron and impurities resulting from the production. The invention also relates to a method for manufacturing said plate and to the use of said plate in the automotive industry.

In the prior art, a steel formation containing Manganese and Aluminium is disclosed in the United States US2013209831. In this patent application a steel according to the

invention contains (in % by weight) carbon C: 0.1-1.0%, Manganese Mn: 10-25% and Aluminium Al: 0.3-2%.

Besides another high strength steel composition is yet disclosed in Chinese patent application CN103556052. The invention discloses automotive high manganese steel and method of manufacturing TWIP steel and chemical composition of the said steel.

The Aim and Brief Description of the Invention

The method as the subject matter of the invention comprises producing an excessively ductile, ultra high strength steel by casting and activation of twinning mechanism (TWIP) or bainite microstructure (TRIP) and processes after the casting. Steel alloy as the subject matter of the invention is an alloy (TWIP steel) having a plasticity property by twinning or bainite microstructure. TWIP steel is concerned as a steel with high ductility and ultra high strength (UHSS: ultra high strength steel). TWIP steel is the most improved steel which is produced by using modern methods and is used in all sectors in which mechanical strength is necessary. The said steel can be used in train rail and train wheel, rim steel, vehicle safety bars, A, B, C pillars, crash bumpers and side pillars, all of the impact absorber parts; high pressure vessels and other Devices and machines which require high pressure resistance, high impact resistance, high strength in nuclear power plants and pipes for different purposes. It can be used in these areas owing to its ability to absorb the vibrations as well as it is able to damp the impact energy at the moment of an impact. This steel can be used as arms and arm's components which requires high strength together with high impact resistance. This steel can be used as undercarriage and passenger seat parts in aircrafts.

In addition to this, it can also be used in the steering wheel, pressure cylinders, tanks, road medians, in the ballistic vest, helmets and armor steel. Its ability to extensionally absorb the energy rather than breaking prevents the possible accidents from growing.

Even when it is used as armor steel, it will contribute to damping energy by absorbing the energy of shrapnel pieces as a result of this its shape becomes deformed. The said steel is used in the production of tow lines, in connection members, pipes, boom base

pins, parts and crane arms of forestry machines, connection members being used in constructions; as well as in undercarriage and it's components, air frame components, connectors, bolts, rivets, turbine discs, exhaust components of helicopter and airplane parts. Different kinds of welding methods can be applied in automotive and other industries.

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Detailed Description of the Invention

The figures used to better explain the invention are listed below.

Figure 1 is the production schemes a, b, c, d, e, and f of Superior Ductility High Strength steel (UHSS).

10 Figure 2 is the Stress-Strain curve (stress-deformation curve) of the superior ductility high strength steel (UHSS) as the subject matter of the invention at 600 MPa and trading steels having tensile strength of 600 MPa.

15 Figure 3 is the Stress-Strain curve (stress-deformation curve) of the superior ductility high strength steel (UHSS) as the subject matter of the invention at 800 MPa and trading steels having tensile strength of 800 MPa.

Figure 4 is the Stress-Strain curve (stress-deformation curve) of the superior ductility high strength steel (UHSS) as the subject matter of the invention at 1000 MPa and trading steels having tensile strength of 1000 MPa.

20 Figure 5 is the Stress-Strain curve (stress-deformation curve) of the superior ductility high strength steel (UHSS) as the subject matter of the invention at 1200 MPa and over and trading steels having tensile strength of 1200 MPa.

The TRIP / TWIP Superior Ductility High Strength steel (UHSS) and the method of manufacturing of this steel basically comprises the following steps;

- a) casting of the steel at determined elemental composition,
- 25 b) homogenization process in order for the casting steel to be homogeneous,
- c) hot rolling process for obtaining steel sheet with suitable thickness from homogenized steel,

- d) cold rolling process for obtaining steel sheet with suitable thickness from hot rolled steel,
- e) if necessary, making intermediate annealing in order to increase cold milling capability and to produce more thinner plate based on the chemical composition and milling capacity,
- f) Heat treatment process of cold rolled steel.

In an embodiment of the invention, the steps "c" and "d" may be repeated several times in order for sheets to be in the desired size. The elemental composition of the invention thereof is, in weight percent: Carbon between (0,01% and 0,8%), Manganese between (10% and 22%), aluminium between (0% and 1,5%), boron between 0,0001% and 0,02%), tungsten between (0,001% and 4%), cobalt between (0,001 and 4%), tantalum between (0,001% and 3%) and the remainder being iron.

Preferably, the elemental composition is, in weight percent: Carbon between (0,2% and 0,4%), Manganese between (16% and 17%), aluminium between (0,3% and 1,5%), boron between 0,0001% and 0,01%), tungsten between (0,02% and 1%), cobalt between (0,3% and 1,5%), tantalum between (0,01% and 0,5%) and the remainder being iron.

During the production of superior ductility high strength steel (UHSS) as the subject matter of the invention, there may be some trace amounts of elements coming from ironstones and scrap. Some of the amounts of these elements that cause no damage and even improve the steel subject to the invention (UHSS) are given below:

Silicium content	: $0 \leq \%Si \leq 1,80$
Vanadium content	: $0 \leq \%V \leq 0,06$
Titanium content	: $0 \leq \%Ti \leq 0,06$
Chromium content	: $0 \leq \%Cr \leq 0,55$
Molybdenum content	: $0 \leq \%Mo \leq 0,3$
Nickel content	: $0 \leq \%Ni \leq 0,55$
Copper content	: $0 \leq \%Cu \leq 0,9$

Sb	: $0 \leq \%Sb \leq 0,06$
Bi	: $0 \leq \%Bi \leq 0,06$
As	: $0 \leq \%As \leq 0,06$
Nb	: $0 \leq \%Nb \leq 0,06$

5 and others (S, P, N, Ca and other elements)

The rolling processes are easily performed thanks to the composition of UHSS wherein Aluminium is 0,3%. However, Aluminium is oxidized and comes to the surface during the alloying of the Aluminium with any composition of iron. Therefore, alloying the iron with large amount of aluminium can be hard even impossible. In order to prevent this
10 problem, Aluminium will be melted with Manganese in composition which contains large amount of Manganese. Superior ductility High Strength Steel (UHSS) alloy will be prepared by blending the two mixtures and corresponding amount of iron and other compounds together.

Tungsten (W) in the obtained alloy will be used instead of molybdenum (Mo) element.
15 The said element can form carbides and improve strength properties. Tantalum (Ta) is another element that can form carbide and Cobalt (Co) will improve mechanical properties by increasing the toughness.

After the casting process of the alloy for UHSS, the heat treatment process for homogenization process is carried out at temperature between 1000°C and 1200°C and
20 the casting material will be allowed to cool itself in air.

In the hot rolling process to be held for the purpose of shaping; the homogenized steel is allowed to stay around 30 minutes to 18 hours according to the size of the steel to be rolled then it is rolled at 1000 C°- 1250 C° in different passes and thinned to the thickness of 0,5 mm- 12 mm and then it is allowed to cool in air.

25 In the cold rolling process for thinning, the pieces at room temperature, are passed through the rollers in the different passes and the deformation can range from 5% to 90% and the cast size can range from 0,25 mm to 8,0 mm.

In order to prevent the stress on the cold rolled material and form the twinning with heat treatment, the steel is lastly heat treated to 500°C- 1100°C tempers around 30 seconds to 250 minutes according to the thickness of the material then allowed to cool. If it is necessary to achieve different stiffness values, it will be cooled in the water or in
5 the oil.

In another embodiment of the invention, the steps "c" and "d" may be repeated several times in order for sheets to be in the desired size. The elemental composition of the invention thereof is, in weight percent: Carbon between (0,02% and 0,6%), Manganese between (5% and 12%), aluminium between (0,4% and 3%), silicium between (0,6% and
10 2,5%), boron between (0,02% and 1%), tungsten between (0,001% and 4%), cobalt between (0,001 and 4%), tantalum between (0,001% and 3%) and the remainder being iron.

Preferably, the elemental composition of the invention thereof is, in weight percent: Carbon between (0,15% and 0,4%), Manganese between (7% and 10%), aluminium between (0,8% and 1,6%), silicium between (1,,2% and 2%), boron between (0,006% and
15 0,5%), tungsten between (0,02% and 1%), cobalt between (0,2% and 0,7%), tantalum between (0,01% and 0,3%) and the remainder being iron.

During the production of superior ductility high strength steel (UHSS) as the subject matter of the invention, there may be some trace amounts of elements coming from
20 ironstones and scrap. Some of the amounts of these elements that cause no damage and even improve the steel reinforced with boron subject to the invention (UHSS) are given below:

Vanadium content	: $0 \leq \%V \leq 0,07$
Titanium content	: $0 \leq \%Ti \leq 0,08$
25 Molybdenum content	: $0 \leq \%Mo \leq 0,3$
Nickel content	: $0 \leq \%Ni \leq 0,75$
Copper content	: $0 \leq \%Cu \leq 1,9$
Sb	: $0 \leq \%Sb \leq 0,06$

As : $0 \leq \%As \leq 0,06$

Nb : $0 \leq \%Nb \leq 0,08$

and others (contents S, P, N, Ca and other elements)

The rolling processes are easily performed thanks to the composition of UHSS wherein
5 Aluminium is between 0,4% and 3%. However, Aluminium is oxidized and comes to the
surface during the alloying of the Aluminium with any composition of iron, preventing a
homogeneous alloy. Therefore, alloying the iron with large amount of aluminium can be
hard even impossible. In order to prevent this problem, Aluminium will be melted with
Manganese in composition which contains large amount of Manganese. Superior
10 ductility High Strength Steel (UHSS) low and medium Manganese-high boron steel alloy
will be prepared by blending the two mixtures and corresponding amount of iron and
other compounds together.

In order to prevent the stress on the cold rolled material and form the twinning with
heat treatment, activation of boron element and the formation of carbides, the steel is
15 lastly heat treated to 500°C- 1100°C tempers around 30 seconds to 250 minutes
according to the thickness of the material then allowed to cool. If it is necessary to
achieve different stiffness values, it will be cooled in the water or in the oil.

In another embodiment of the invention, the steps "c" and "d" may be repeated several
times in order for sheets to be in the desired size. The elemental composition of the
20 invention thereof is, in weight percent: Carbon between (0,02% and 0,6%), Manganese
between (10% and 13%), aluminium between (0,4% and 3%), silicium between 0,6% and
2,5%, boron between 0,002% and 1%), chromium 0,01% and 5%, tungsten between
(0,01% and 4%), cobalt between (0,0001 and 4%), tantalum between (0,0001% and 3%)
and the remainder being iron.

25 Preferably, the elemental composition is, in weight percent: Carbon between (0,1% and
0,4%), Manganese between (11% and 12%), aluminium between (0,8% and 1,6%), boron
between 0,0001% and 0,01%), chromium between 0,4% and 1%, silicium between 1,2%
and 2%, tungsten between (0,02% and 1%), cobalt between (0,2% and 0,7%), tantalum
between (0,01% and 0,3%) and the remainder being iron.

During the production of superior ductility high strength steel (UHSS) as the subject matter of the invention, there may be some trace amounts of elements coming from ironstones and scrap. Some of the amounts of these elements that cause no damage and even improve the steel reinforced with boron subject to the invention (UHSS) are given below:

Vanadium content	: $0 \leq \%V \leq 0,07$
Titanium content	: $0 \leq \%Ti \leq 0,08$
Molybdenum content	: $0 \leq \%Mo \leq 0,3$
Nickel content	: $0 \leq \%Ni \leq 0,75$
10 Copper content	: $0 \leq \%Cu \leq 1,9$
Sb	: $0 \leq \%Sb \leq 0,06$
As	: $0 \leq \%As \leq 0,06$
Nb	: $0 \leq \%Nb \leq 0,08$

and others (S, P, N, Ca and other elements)

15 In another embodiment of the invention, the steps "c" and "d" may be repeated several times in order for sheets to be in the desired size. The elemental composition of the invention thereof is, in weight percent: Carbon between (0,01% and 1,2%), Manganese between (<4% and <22%), aluminium between (0.2% and 7%), silicium between (0.2% and 8%), boron between 0.0001% and 1%), Nickel between (0.0001% and 5%), chromium
20 between (0.0001% and 5%), tungsten between (0.0001% and 4%), cobalt between (0.0001% and 4%), tantalum between (0.0001% and 3%) and low ratio others elements and the remainder being iron.

Preferably, the elemental composition of the invention thereof is, in weight percent: Carbon between (0,07% and 0,8%), Manganese between (4% and 20%), aluminium
25 between (0,2% and 6%), silicium between (0,2 % and 6%), boron between 0.0001% and 0,5%), Nickel between (0.0001% and 3%), tungsten between (0.0001% and 1,0%), cobalt between (0.0001% and 2%), tantalum between (0.0001% and 2%), Chromium between 0.0001% and 4% and low ratio others elements and the remainder being iron.

More preferably, the elemental composition of the invention thereof is, in weight percent: Carbon between (0,07% and 0,8%), Manganese between (4% and 13%), aluminium between (0,3% and 5%), silicium between (0,3 % and 6%), boron between 0.0001% and 0,4%), Nickel between (0.0001% and 3%), tungsten between (0.0001% and 1,0%), cobalt between (0.0001% and 2%), tantalum between (0.0001% and 1,5%) and low ratio others elements and the remainder being iron.

During the production of low and medium Manganese TRIP/TWIP steel reinforced with boron as the subject matter of the invention, there may be some trace amounts of elements coming from iron stones and scrap. Some of the amounts of these elements that cause no damage and even improve our invention (UHSS) are given below:

Vanadium content	: $0 \leq V\% \leq 4$
Titanium content	: $0 \leq Ti\% \leq 3$
Molybdenum content	: $0 \leq Mo\% \leq 5$
Copper content	: $0 \leq Cu\% \leq 2,5$
15 Sb	: $0 \leq Sb\% \leq 0,1$
As	: $0 \leq As\% \leq 0,1$
Nb	: $0 \leq Nb\% \leq 1.5$
P	: $0 \leq P\% \leq 1.0$
N	: $0 \leq N\% \leq 1.0$

20 and others (contents S, Pb, Te, Ca and other elements)

The rolling processes are easily performed thanks to the composition of UHSS wherein Aluminium is between 0,2% –7%. However, Aluminium is oxidized and comes to the surface during the alloying of the Aluminium with any composition of iron. Therefore, alloying the iron with large amount of aluminium can be hard even impossible. In order to prevent this problem, Aluminium will be melted with Manganese in composition which contains large amount of Manganese. Superior ductility High Strength Steel (UHSS) low and medium Manganese-high boron steel alloy will be prepared by blending the two mixtures and corresponding amount of iron and other compounds together.

Tungsten element in the obtained alloy will be used instead of molybdenum element. (Tungsten/Molybden or Molybden/Tungsten ratios 1/2 - 1/4). The said element can form carbides and improve strength properties. Tantalum is another element that can form carbide and Cobalt will improve mechanical properties by increasing the toughness. Nickel element will be used in austenitic microstructure is due to the low manganese ratio constructive feature. Nickel will be used increasingly manganese ratio is reduced.

After the casting process of the alloy for UHSS Steel Reinforced with Boron and Nickel Elements, the heat treatment process for homogenization process is carried out at temperature between 1000°C and 1200°C and the casting material will be allowed to cool itself in air.

In the hot rolling process to be held for the purpose of shaping; the homogenized steel is allowed to stay around 30 minutes to 25 hours according to the size of the steel to be rolled then it is rolled at 1000 C°- 1250 C° in different passes and thinned to the thickness of 0,5 mm- 250 mm and then it is allowed to cool in air.

In the cold rolling process for thinning, the pieces at room temperature or up 500 °C, are passed through the rollers in the different passes and the deformation can range from 5% to 90% and the cast size can range from 0,15 mm to 245 mm.

Cold rolling of a thick plate becomes more difficult during repeated thinning processes because of work hardening. It may be needed intermediate annealing for milling in order to get more thinner plate and increasing cold rolling capability depending on the chemical composition of the steel. In this case, plate will be annealed in between 900 °C-1250 °C for 10 min-30 h.

In order to prevent the stress on the cold rolled material and form the twinning with heat treatment, activation of boron element and the formation of carbides, the steel is lastly heat treated to 500°C- 1100°C tempers around 30 seconds to 1200 minutes according to the thickness of the material then allowed to cool. If it is necessary to achieve different stiffness values, it will be cooled in the water or in the oil.

To provide the ultimate mechanical properties of the steel, one of the 6 different annealing methods will be applied in the final phase (Figure 1). One method will be determined to achieve the targeted microstructure and mechanical properties.

5 After the heat treatment, steel will be cooled in air, oil, water or in the furnace. Heat treatment time may vary between 30 seconds to 1500 minutes (25 hours). Steel without heat treatment; be used as cold rolled.

CLAIMS

1. In order to produce superior ductility high strength steel (UHSS) having high stretching and elongation values and a composition of superior ductility high strength steel is characterized by following steps;
- 5
- the casting process is performed (in % by weight) wherein carbon between (0,01% and 0,8%), Manganese between (10% and 22%), aluminium between (0% and 1,5%), boron between 0,0001% and 0,02%), tungsten between (0,001% and 4%), cobalt between (0,001% and 4%), tantalum between

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 - (0,001% and 3%) and the remainder being iron,
 - the heat treatment process for homogenization process is performed at temperature between 1000°C and 1200°C,
 - in the hot rolling process to be held for the purpose of shaping; the homogenized steel is allowed to stay around 30 minutes to 18 hours

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 - according to the size of the steel to be rolled then it is rolled at 1000 C°- 1250 C° in different passes and thinned to the thickness of 0,5 mm- 12 mm and then allowed to cool in air,
 - in the cold rolling process for thinning, the pieces at room temperature, are passed through the rollers in the different passes and the deformation can

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 - range from 5% to 90% and the cast size can range from 0,25 mm to 8,0 mm,
 - as a final process, the steel is heat treated to 500°C- 1100°C tempers around 30 seconds to 250 minutes according to the thickness of the material then it is allowed to cool.
2. A composition of superior ductility high strength steel (UHSS) and a steel
- 25
- accordingly produced according to claim 1, characterized in that the composition thereof is, in weight percent: Carbon between (0,2% and 0,4%), Manganese between (16% and 17%), aluminium between (0,3% and 1,5%), boron between 0,0001% and 0,01%), tungsten between (0,02% and 1%), cobalt between (0,3% and 1,5%), tantalum between (0,01% and 0,5%) and the remainder being iron.

3. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to claim 1, characterized in that in case of Aluminium is at least 0,3%, instead of the alloying process of the iron with large amount of Aluminium, Aluminium is melted with Manganese in composition which contains large amount of Manganese and blending the two mixtures and corresponding amount of iron and other compounds together is performed.
4. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to claim 1, characterized in that the mixture to be used for casting that causes no damage even provides improvements in technical properties thereof is, in weight percent silicium between 0%-1,80%, vanadium between 0%-0,06%, titanium between 0%-0,06%, chromium between 0%-0,55%, molybdenum between 0%-0,3%, nickel between 0%-0,55%, copper between 0%-0,9%, antimony between 0%-0,06%, bismuth between 0%-0,06%, arsenic between 0%-0,06%.
5. In order to produce superior ductility high strength steel (UHSS) having high stretching and elongation values and a composition of superior ductility high strength steel is characterized by following steps;
- the casting process is performed (in % by weight) wherein carbon between (0,02% and 0,6%), Manganese between (5% and 12%), aluminium between (0,4% and 3%), silicium between (0,6% and 2,5%), boron between (0,02% and 1%), tungsten between (0,001% and 4%), cobalt between (0,001 and 4%), tantalum between (0,001% and 3%) and the remainder being iron,
 - the heat treatment process for homogenization process is performed at temperature between 1000°C and 1200°C,
 - in the hot rolling process to be held for the purpose of shaping; the homogenized steel is allowed to stay around 30 minutes to 18 hours according to the size of the steel to be rolled then it is rolled at 1000 C°- 1250 C° in different passes and thinned to the thickness of 0,5 mm- 12 mm and then allowed to cool in air,

- in the cold rolling process for thinning, the pieces at room temperature, are passed through the rollers in the different passes and the deformation can range from 5% to 90% and the cast size can range from 0,25 mm to 8,0 mm,
 - as a final process, the steel is heat treated to 500°C- 1100°C tempers around 30 seconds to 250 minutes according to the thickness of the material then it is allowed to cool.
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6. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to claim 5, characterized in that the composition thereof is, in weight percent: Carbon between (0,15% and 0,4%), Manganese between (7% and 10%), aluminium between (0,8% and 1,6%), silicium between (1,2% and 2%), boron between (0,006% and 0,5%), tungsten between (0,02% and 1%), cobalt between (0,2% and 0,7%), tantalum between (0,01% and 0,3%) and the remainder being iron.
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7. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to claim 5, characterized in that in case of Aluminium is at least 0,8%, instead of the alloying process of the iron with large amount of aluminium, Aluminium is melted with Manganese in composition which contains large amount of Manganese and blending the two mixtures and corresponding amount of iron and other compounds together is performed.
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8. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to claim 5, characterized in that the mixture to be used for casting that causes no damage even provides improvements in technical properties thereof is, in weight percent, vanadium between 0%-0,06%, titanium between 0%-0,06%, molybdenum between 0%-0,06%, nickel between 0%-0,06%.
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9. In order to produce superior ductility high strength steel (UHSS) having high stretching and elongation values and a composition of superior ductility high strength steel is characterized by following steps;
- the casting process is performed (in % by weight) wherein carbon between (0,02% and 0,6%), Manganese between (10% and 13%), aluminium between (0,4% and 3%), silicium between (0,6% and 2,5%), boron between (0,002%
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- and 1%), tungsten between (0,01% and 4%), cobalt between (0,0001 and 4%), tantalum between (0,0001% and 3%) and the remainder being iron,
- the heat treatment process for homogenization process is performed at temperature between 1000°C and 1200°C,
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- in the hot rolling process to be held for the purpose of shaping; the homogenized steel is allowed to stay around 30 minutes to 18 hours according to the size of the steel to be rolled then it is rolled at 1000 C^o- 1250 C^o in different passes and thinned to the thickness of 0,5 mm- 12 mm and then allowed to cool in air,
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- in the cold rolling process for thinning, the pieces at room temperature, are passed through the rollers in the different passes and the deformation can range from 5% to 90% and the cast size can range from 0,25 mm to 8,0 mm,
 - as a final process, the steel is heat treated to 500°C- 1100°C tempers around 30 seconds to 250 minutes according to the thickness of the material then it
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- is allowed to cool.
10. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to claim 9, characterized in that the composition thereof is, in weight percent: Carbon between (0,1% and 0,4%), Manganese between (11% and 12%), aluminium between (0,8% and 1,6%), silicium between
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- (1,2% and 2%), boron between (0,005% and 0,5%), tungsten between (0,02% and 1%), cobalt between (0,2% and 0,7%), tantalum between (0,01% and 0,3%) and the remainder being iron.
11. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to claim 9, characterized in that in case of
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- Aluminium is at least 0,8%, instead of the alloying process of the iron with large amount of aluminium, Aluminium is melted with Manganese in composition which contains large amount of Manganese and blending the two mixtures and corresponding amount of iron and other compounds together is performed.
12. A composition of superior ductility high strength steel (UHSS) and a steel
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- accordingly produced according to claim 9, characterized in that the mixture to be used for casting that causes no damage even provides improvements in

technical properties thereof is, in weight percent, vanadium between 0%-0,06%, titanium between 0%-0,06%, molybdenum between 0%-0,06%, nickel between 0%-0,06%.

13. In order to produce superior ductility high strength Reinforced steel with Boron (UHSS) low and medium Manganese high boron and high nickel steel having high strain and elongation values and a composition of superior ductility high strength steel is characterized by following steps;

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- the casting process is performed (in % by weight) wherein carbon between (0.01% and 1.2%), Manganese between (<4% and <22%), aluminium between (0.2% and 7%), silicium between (0.1% and 8%), boron between 0.0001% and 1%), chromium between (0.0001% and 5%), tungsten between (0.0001% and 4%), cobalt between (0.0001% and 4%), tantalum between (0.0001% and 3%), nickel between (0.001% and 5%), and other elements and the remainder being iron,
- the heat treatment process for homogenization process is performed at temperature between 1000°C and 1250°C,
- in the hot rolling process to be held for the purpose of shaping; the homogenized steel is allowed to stay around 30 minutes to 25 hours according to the size of the steel to be rolled then it is rolled at 1000 °C- 1250 °C in different passes and thinned to the thickness of 0.5 mm- 250 mm and then allowed to cool in air,
- in the cold rolling process for thinning, the pieces at room temperature or up to 500 °C, are passed through the rollers in the different passes and the deformation can range from 1% to 90% and the cast size can range from 0.15 mm to 245 mm,
- as a final process, the steel is heat treated to 500°C- 1100°C tempers around 30 seconds to 25 hours according to the thickness of the material then it is allowed to cool.

14. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to claim 13, characterized in that the composition thereof is, in weight percent: Carbon between (0.03% and 0.8%), Manganese between (4% and 20%), aluminium between (0.2% and 6%), silicium between (0.2% and 6%), boron between (0.0001% and 0.5%), chromium between (0.0001% and 4%) tungsten between (0.0001% and 1%), cobalt between (0.0001% and 2%), tantalum between (0.0001% and 2%), nickel between (0.0001% and 3%) other elements and the remainder being iron.
15. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to claim 13, characterized in that the composition thereof is, in weight percent: Carbon between (0.03% and 0.8%), Manganese between (4% and 18%), aluminium between (0.3% and 6%), silicium between (0.2% and 6%), boron between (0.0001% and 0.4%), chromium between (0.0001% and 4%) tungsten between (0.0001% and 1%), cobalt between (0.0001% and 2%), tantalum between (0.0001% and 2%), nickel between (0.0001% and 3%), other elements and the remainder being iron.
16. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to claim 13, characterized in that the composition thereof is, in weight percent: Carbon between (0,03% and 0,8%), Manganese between (4% and 14%), aluminium between (0,3% and 6%), silicium between (0,3 % and 6%), boron between 0.0001% and 0,4%), Nickel between (0.0001% and 3%), tungsten between (0.0001% and 1,0%), cobalt between (0.0001% and 2%), tantalum between (0.0001% and 1,5%) and low ratio others elements and the remainder being iron.
17. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to claim 13, characterized in that in case of Aluminium is at least 0.3%, instead of the alloying process of the iron with large amount of aluminium, Aluminium is melted with Manganese in composition which contains large amount of Manganese and blending the two mixtures and corresponding amount of iron and other compounds together is performed.

18. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to claim 13, characterized in that the mixture to be used for casting that causes no damage even provides improvements in technical properties thereof is, in weight percent vanadium between 0%-4%, titanium between 0%-3%, molybdenum between 0%-5%, other trace elements are totally in between 0%-5%,
19. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to any of claims 1, 5, 9 or 13, characterized in that the said steel can be used in train rail and train wheel, rim steel, vehicle safety bars, A, B, C pillars, bumpers and side pillars owing to its ability to absorb the vibrations as well as to damp the impact energy at the moment of an impact.
20. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to any of claims 1, 5, 9 or 13, characterized in that it can also be used in the steering wheel, pressure cylinders, tanks, road medians, in the ballistic vest, Firearm, military supplies, helmets and armor steel. Its ability to extensionally absorb the energy rather than breaking.
21. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to any of claims 1, 5, 9 or 13, characterized in that said steel is used owing to its high strain strength property in the production of tow lines, pipes connection members, Boom base pins, parts and crane arms of forestry machines being used in constructions.
22. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to any of claims 1, 5, 9 or 13, characterized in that said steel is used in helicopter and airplane parts; Undercarriage and it's components, air frame components, connectors, bolts, rivets, turbine discs, exhaust components.
23. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to any of claims 1, 5, 9 or 13, characterized in

that said steel is convenient to different kinds of welding methods applied in automotive and other industries.

5 24. A composition of superior ductility high strength steel (UHSS) and a steel accordingly produced according to any of claims 1, 5, 9 or 13, characterized in that said steel is used in devices and machines which require high pressure resistance, high impact resistance, high strength as in nuclear power plants.

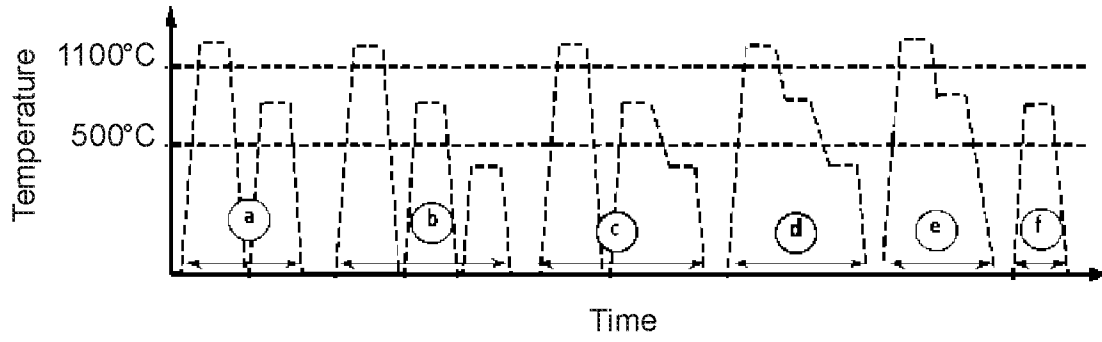


Figure 1

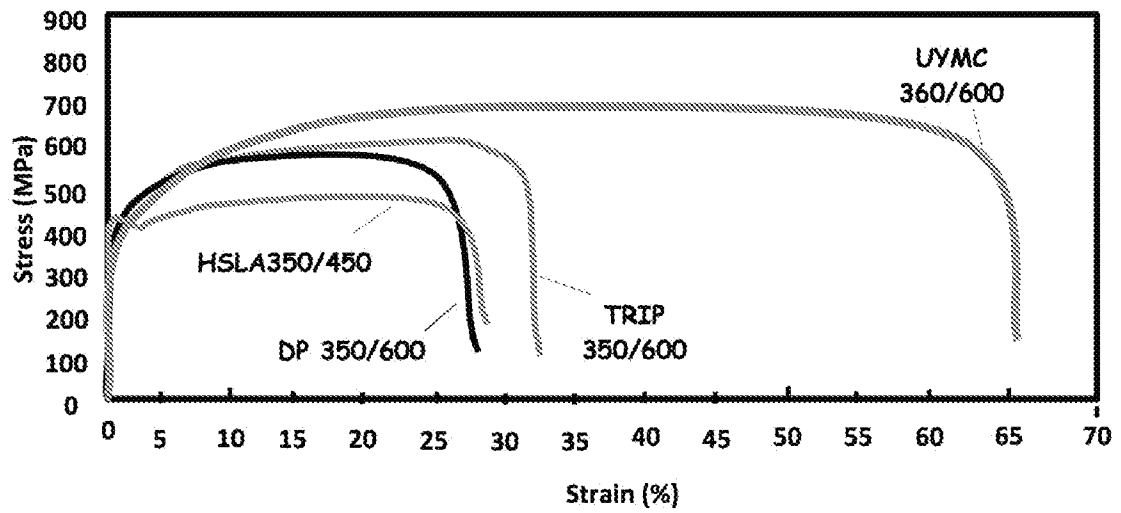


Figure 2

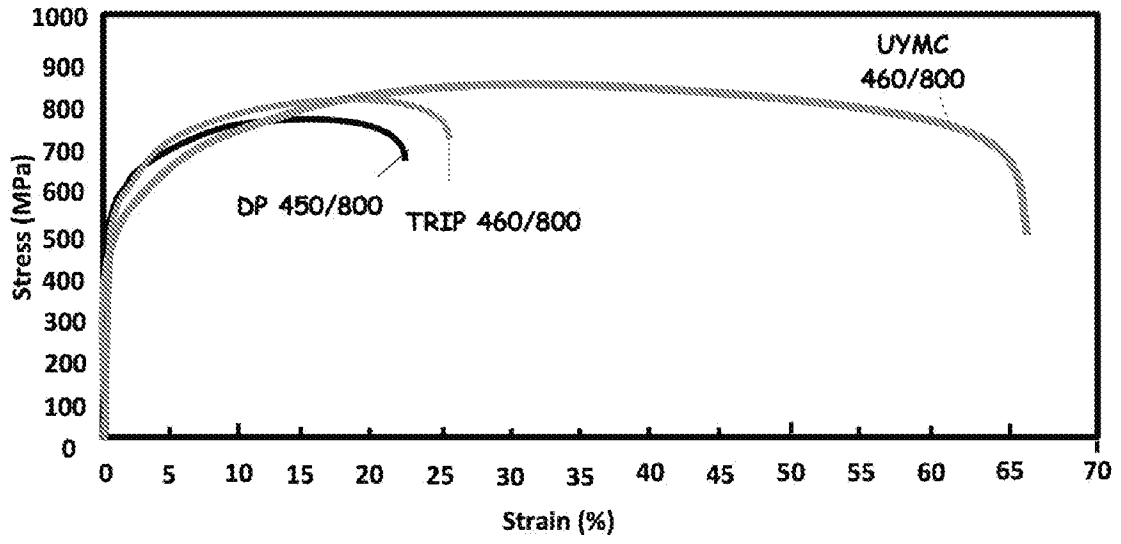


Figure 3

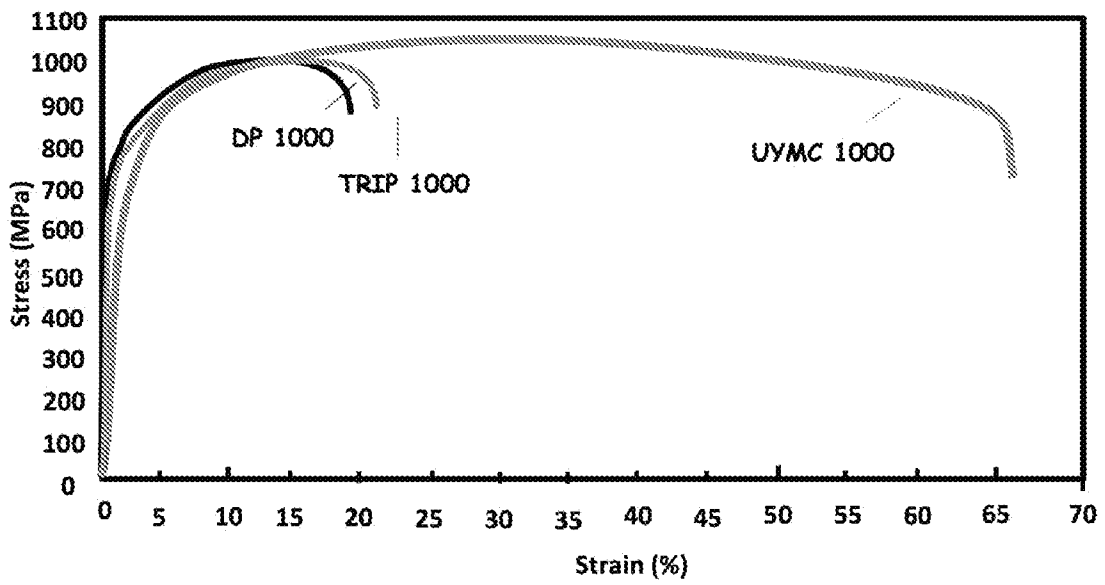


Figure 4

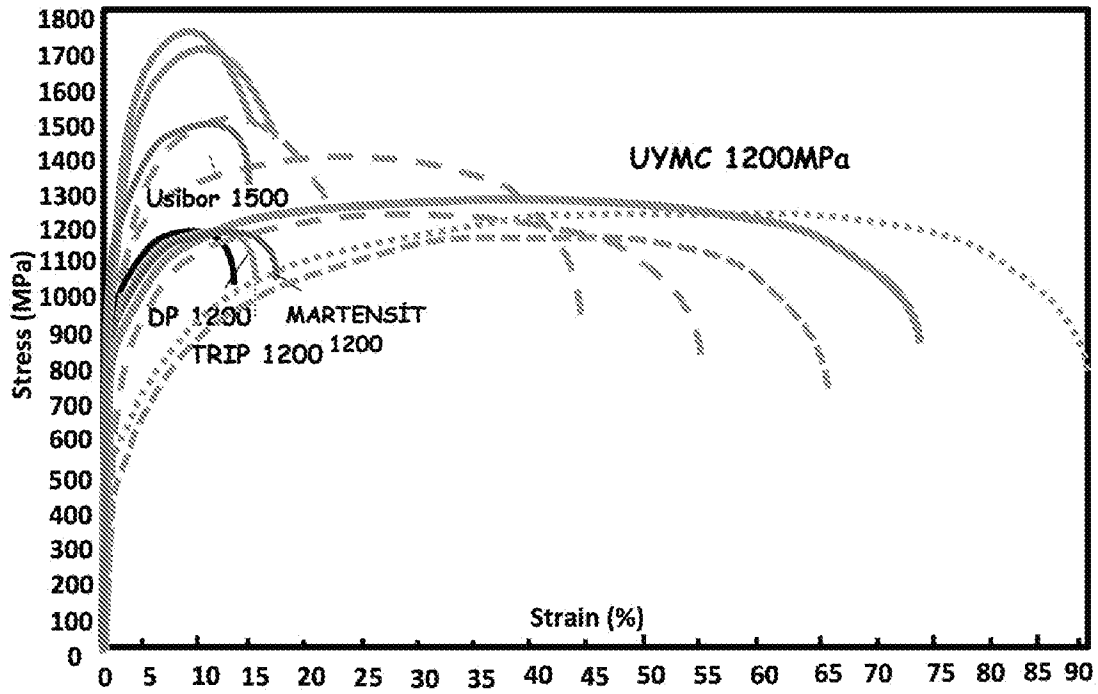


Figure 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/TR2015/050010

A. CLASSIFICATION OF SUBJECT MATTER INV. C21D7/02 C21D7/13 C22C38/00 C22C38/58 ADD.		
According to International Patent Classification (IPC) or to both national classification and IPC		
B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) C21D C22C		
Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched		
Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) EPO-Internal, WPI Data		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 2 090 668 A1 (CORUS STAAL BV [NL]) 19 August 2009 (2009-08-19) tables 1-2	1-24
X	----- HAMADA A S ET AL: "Fatigue Behavior of Four High-Mn Twinning Induced Plasticity Effect Steels", METALLURGICAL AND MATERIALS TRANSACTIONS A, SPRINGER-VERLAG, NEW YORK, vol. 41, no. 5, 17 March 2010 (2010-03-17) , pages 1102-1108, XP019796841, ISSN: 1543-1940 the whole document	1-24
X	----- US 2013/209833 A1 (SCOTT COLIN [FR] ET AL) 15 August 2013 (2013-08-15) tables 1-2 ----- -/--	1-24
<input checked="" type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.		
* Special categories of cited documents :		
"A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art "&" document member of the same patent family	
Date of the actual completion of the international search <p style="text-align: center;">1 September 2015</p>	Date of mailing of the international search report <p style="text-align: center;">09/09/2015</p>	
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer <p style="text-align: center;">Liu, Yonghe</p>	

INTERNATIONAL SEARCH REPORT

International application No PCT/TR2015/050010

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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X	CN 103 556 052 A (WUHAN IRON & STEEL GROUP CORP) 5 February 2014 (2014-02-05) cited in the application table 1 -----	1-24
X	CN 102 345 077 A (UNIV SOUTHWEST PETROLEUM) 8 February 2012 (2012-02-08) examples 1-4; tables 1-2 -----	1-24

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