

Glossary of Stainless Steel Related Terms

Term	Explanation
200 Series	A group of austenitic stainless steels derived from the AISI numbering system. Based on substituting manganese for nickel to provide the austenitic structure.
300 Series	A group of austenitic stainless steels derived from the AISI numbering system. Based on the use of nickel to provide the austenitic structure.
400 Series	A group of ferritic and martensitic stainless steels derived from the AISI numbering system. Characterised by no or low nickel .
Acid Corrosion	Also called general corrosion . Characterised by uniform metal loss. Contrast with pitting corrosion .
Alloy	A combination of two or more metals or other elements . Steel is an alloy of iron and carbon .
Alumina	Aluminium oxide (AL ₂ O ₃). An abrasive used on polishing belts and wheels to give a directional polish. On a micro-level gives a non-uniform appearance. Prone to trapping contaminants and giving disappointing results in external architectural applications.
Aluminium	An element (symbol AL) used to improve oxidation resistance in ferritic stainless steels and strength in precipitation hardening steels.
Annealing	A general term in heat treatment usually referring to a softening process.
AOD Vessel	Argon oxygen decarburisation vessel. A development in the refining process allowing cheaper production of stainless steel.
Atom	The smallest particle of an element .
Austenitic	The most common type of stainless steels. The austenitic structure gives the characteristic properties of this type including: Formability Weldability Work hardening Non-magnetic At an atomic level austenitic is a face centred cubic structure.
Billet	The starting point for the production of long products such as rod . May be continuously cast or rolled from ingot or bloom . Typical section size 150 mm.
Bloom	The starting point for the production of long products such as bar and rod . May be continuously cast or rolled from ingot . Typical section size 300-400 mm.
Brearley	Harry Brearley is the Sheffield metallurgist connected with the invention of stainless steel.
Bright annealing	The softening of stainless steel in an inert atmosphere to preserve the bright cold rolled surface.
Brittle	Showing low level of energy absorbed in an impact toughness test.

Carbon	The essential element (symbol C) added to iron to make steel . In stainless steel, the range of carbon content is very wide from about 0.015-1% depending on the properties required.
Casting	A product that is used in the as-cast condition, that is without mechanical working. The main benefit is that intricate shapes can be formed by pouring liquid metal into a mould. Castings have poorer mechanical properties compared to wrought products due to their coarser microstructure.
Chemical symbol	An abbreviation of the name of an element. Chromium = Cr.
Chloride	A type of ion , symbol CL, which is among the most common chemical species to be detrimental to the passive film on stainless steel. Seawater contains about 3% NaCl (sodium chloride). Chloride can cause pitting corrosion , crevice corrosion and stress corrosion cracking .
Chromium	The metallic element (symbol Cr) which is in all stainless steels. Forms a passive oxide layer which prevents corrosion .
Compound	A combination of two or more elements which is quite different in nature to any of the constituents.
Continuous casting	A method of casting allowing continuous casting of slab , bloom or billet . Reduced cost and improved yield compared to individual ingot casting.
Continuously Produced Plate (CPP)	Plate cut from hot rolled coil. A maximum thickness of about 13 mm in widths of up to 2000 mm can be produced via this process route. Sometimes called coil plate.
Copper	Element (symbol Cu) normally found in all steels in small quantities. Deliberately added to stainless steel to improve resistance to acids such as sulphuric acid and to lower the work hardening for cold heading of fasteners.
Corrosion	The attack of a metal or alloy by a chemical substance. It is electrochemical in nature.
Creep	A type of deformation which depends on the time as well as the steel applied. In steels, this phenomenon is important above about 550°C.
Crevice Corrosion	A type of corrosion resulting from the exclusion of oxygen from between tightly contacting surfaces.
Critical Crevice Temperature (CCT)	The temperature at which a stainless steel starts to show crevice corrosion in a standard laboratory solution. Used for comparing stainless steels.
Critical Pitting Temperature (CPT)	The temperature at which a stainless steel starts to show pitting corrosion in a standard laboratory solution. Used for comparing stainless steels.
Crystal	A structure which, at the atomic level, has a regular arrangement of atoms .
Deep Drawing	A method of forming involving pressing a sheet into a hollow mould without restraining the outer edges of the sheet. Compare with stretch forming .
Ductile	Two distinct meanings: 1) A material is said to be ductile if it shows a high level of elongation in the tensile test. 2) A material is said to be ductile if it shows a high level of absorbed energy in an impact toughness test.

Ductile/Brittle Transition Temperature	The temperature at which a series of impact test specimens shows 50% brittle and 50% ductile fracture surfaces.
Duplex	A type of stainless steel having approximately 50% austenite and 50% ferrite . This gives it higher strength than either structure on its own.
Elongation	In a tensile test , the % increase in the gauge length on the test sample.
En	“Emergency number”. An obsolete (from 1970) type of grade used in British standards. It is still used mainly because many drawings and specifications in use date back before the official date of obsolescence.
EN Standard	European Norm. EN Standards are published in the main European languages by each national standards body. BS EN is published by British Standards in English. DIN EN in German and AFNOR EN in French.
Ferritic	A type of stainless steel based on chromium and only small additions of other elements . At an atomic level ferritic is a body centred cubic structure.
Forging	The deformation of metal usually from high temperature. Open-die forging allows a rough approximation of the final shape to be achieved. Closed-die forging or drop forging using a mould allows a shape much closer to the final shape to be achieved.
Formability	Loose term covering a wide range of processes. Generally it means the ability to be formed into complex shapes. Formability is dependent on the grade of steel, its mechanical properties and the forming operation. It is important to note that formability in one type of operation may not carry over to another. Stretch forming and deep drawing are examples of forming operations.
Formula	Shorthand way of writing a compound . Example Fe_2O_3 is iron oxide .
Galvanic corrosion	A type of corrosion involving the contact of dissimilar metals joined by an electrolyte. In some circumstances stainless steel and aluminium in contact can accelerate the corrosion of the aluminium.
Grade	A type of steel or other metallic alloy with defined chemical composition limits.
Grit size	The nominal size of abrasive particles on a polishing belt or wheel. 180, 240 and 320 are common grit sizes. The abrasive material eg alumina or silicon carbide is important in determining the surface roughness.
Hardness	The ability of a material to withstand the indentation by a hardened steel or diamond indenter. Methods of hardness testing include Brinell, Vickers and Rockwell. Charts showing conversions between different methods and conversion to UTS should be treated with caution.
Heat treatment	The use of heating and cooling of a substance usually with the intention of modifying its microstructure and therefore its mechanical properties . Heat treatments relevant to stainless steel include: Solution annealing Quenching Tempering Stress relieving Precipitation hardening

Ion	An atom or molecule which has an excess or lack of electrons thereby giving it a positive or negative electric charge.
Impact toughness	The ability of a material to resist a sudden impact. Measured in the Charpy test by allowing a swinging hammer to hit a small notched sample and measuring the distance swung after the impact. All steels except austenitic types show a sudden loss of impact toughness at low temperatures.
Ingot	A discrete lump of cast metal poured into individual moulds. Depending on shape can be further rolled into slab or bloom . Also used in forging .
Intergranular corrosion	A form of corrosion caused by the formation of chromium carbide which reduces the chromium content of the steel below that required to form the passive film .
Iron	Metallic element (symbol Fe) which is the basis for all steels . In its pure form it is soft.
Lattice	A pattern or regular arrangement of atoms often in a simple geometric shape such as a cube or prism.
Lean Duplex	An imprecise term applied to duplex stainless steels with a lower alloy content than 2205 (1.4462) grade duplex steel.
Magnetic Permeability	More accurately Relative Magnetic Permeability. A measure of a material's ability to be attracted by a magnet. A relative magnetic permeability of 1 means completely non-magnetic.
Manganese	Element (symbol Mn) normally found in all steels. Added to stainless steel as an alternative to nickel to give the austenitic structure in the 200 series .
Martensitic	A type of stainless steel based on chromium and small additions of other elements. Levels of carbon can be high, allowing the quenching and tempering of the steel to very high strength.
Molecule	The smallest particle of a compound . A molecule contains 2 or more atoms .
Metal	An element that is usually shiny, easy to form, conducts heat and electricity well.
Molybdenum	Metallic element (symbol Mo) used to improve resistance to pitting and crevice corrosion in stainless steels.
Multiple Certification	The practice of certifying a batch of steel to more than one grade or standard. Allows more efficient production in the melting shop and more flexibility at the stockholder. Common examples are: 1.4301/1.4307 (304/304L) 1.4401/1.4404 (316/316L) EN 10088-2/EN 10028-7 EN 10088-2/ASTM A240 EN 10088-3/BS 970
Nanometre	One-millionth of a millimetre or 10^{-9} metres. The passive film on stainless steel is a few nanometres thick.
Nickel	Metallic element (symbol Ni) used in stainless steel to give improved weldability and formability . Also improves high temperature oxidation resistance.
Niobium	A metallic element (symbol Nb) used in stainless steels to prevent formation of chromium carbide which can lead in turn to intergranular corrosion .

Nitrogen	An element (symbol N) which is used to give higher strength, increased pitting corrosion resistance and lower magnetic permeability in stainless steels.
Oxidation	The high temperature combination of a metal or alloy with oxygen in the atmosphere.
Passivation	The process of forming the passive film on the surface of stainless steel. Stainless steel passivates in normal atmospheric conditions. However passivation can be accelerated using acids such as nitric or citric.
Passive Film	The chromium oxide layer that forms on stainless steel to give it corrosion resistance.
Pickling	The removal of high temperature oxide from the surface of stainless steel. High temperature oxide is formed during processes such as hot working and welding. If left un-pickled high temperature oxide reduces corrosion resistance. Strong acids such as a mixture of nitric and hydrofluoric are commonly used.
Pitting Corrosion	Corrosion characterised by local attack. Caused by chemical species notably chloride ions . Contrast with general corrosion.
Pitting Resistance Equivalent Number (PREN)	A measure of the ability of a stainless steel to resist pitting corrosion . Calculated from the formula: $\text{PREN} = \%Cr + 3.3 \times (\%Mo + 0.5 \times \%W) + 16 \times \%N$
Polished	An overall term covering wide range of surface finishes on stainless steel including dull polished, satin polished, bright polished . In defining a polished finish it is advisable to use surface roughness, Ra , to describe the required finish.
Precipitation Hardening	A heat treatment in certain special steels which forms tiny particles leading to high strength.
Proof Stress	In a tensile test , stress at which the sample shows a particular strain, often 0.2%. Used in place of a defined yield stress.
Quarto Plate	Hot rolled plates made from rolled slab on a reversing mill. Quarto plates remain flat throughout processing. Thicknesses of up to 150 mm can be produced by this method. Contrast with Continuously Produced Plate .
Ra	A measure of surface roughness. An important factor in determining the corrosion resistance of a stainless steel surface. Measured in micron = one thousandth of a millimetre. An Ra of <0.5 micron is regarded as acceptable for external architectural applications.
Residual Element	An element which is not deliberately added to stainless steel. These elements cannot be removed during the steelmaking process. Copper, tin, zinc and lead are examples.
Rust	Iron oxide. The produce of corrosion in steels.
Sensitisation	The precipitation of chromium carbide as a result of holding stainless steel at temperatures around 650°C. Can give rise to intergranular corrosion . Prevented by using low carbon <0.030% or using titanium or niobium to combine preferentially with carbon .
Silicon	Element (Symbol Si) normally found in all steels. Added to stainless steel for high temperature oxidation resistance.

Silicon carbide	SiC. An abrasive used on polishing belts and wheels to give a directional polish. On a micro-level gives a uniform appearance. For the same grit size gives a much better corrosion performance than alumina .
Steel	An alloy of iron and carbon . Other elements added to steel to improve the mechanical properties include chromium , nickel , molybdenum and manganese .
Steel Name	In the EN Standards, this is a long description of a grade of steel. For example, X5CrNi18-10. This is the Steel Name for Steel Number 1.4301. The X = stainless. Cr and Ni show the main elements and the 18 10 show the approximate contents of the elements .
Steel Number	In the EN Standards, this is the short description of grade of steel. For example, 1.4301. The number is partly meaningful. The first “1” indicates steel. “4” indicates a stainless steel. The last 3 digits are effectively arbitrary.
Strain	The increase per unit length when a material has a stress applied to it.
Stress	The load applied to a material divided by the area over which it is applied. Common units of stress include: N/mm ² = Newtons per square millimetre MPa = Megapascals (identical to N/mm ²) These are used in EN Standards tsi = tons per square inch This was used in the old BS standards psi = pounds per square inch ksi = thousands of pounds per square inch Used in American standards
Stress Corrosion Cracking	A type of corrosion requiring a tensile stress , a sufficiently high temperature and a corrosive environment.
Stretch Forming	A method of forming involving pressing a sheet into a hollow mould whilst restraining the outer edges of the sheet allowing stretching to occur. Compare with deep drawing .
Sulphur	An element (symbol S) used to improve the machinability of steels. In genuine free-machining steels a content of at least 0.15% S is used.
Superduplex	A generic term applied to duplex stainless steels with at least 25% chromium .
Tempering	A heat treatment usually following a hardening operation which softens martenistic steels to provide a useful combination of strength and ductility .
Temper Rolling	A rather misleading term meaning cold working to produce an increase in strength. Stainless steel can be supplied in a number of “tempers” eg quarter hard, half hard, three quarter hard, full hard. These correspond to increasing levels of strength/hardness and decreasing elongation and therefore formability.

Tensile Test	A mechanical test involving the slow pulling apart of a standard test sample. The test measures: 0.2% Proof Stress Ultimate Tensile Stress (UTS) Elongation
Thermal Conductivity	The ability of a material to allow heat to pass through it. Austenitic stainless steels have a lower value than ferritic stainless steels or carbon steels.
Thermal Expansion Coefficient	The measure of the increase in size of a material with increased temperature. Austenitic stainless steels have a higher value than ferritic stainless steels or carbon steels.
Titanium	A metallic element (symbol Ti) used in stainless steels to prevent formation of chromium carbide which can lead in turn to intergranular corrosion .
Tungsten	A metallic element (symbol W) used to improve pitting corrosion in some duplex stainless steels.
Ultimate Tensile Stress (UTS)	In a tensile test , the maximum stress measured on the sample before the sample fractures.
Weldability	A general term meaning that a material can be welded without requiring pre-heating or post-heating, tight control of welding parameters and resulting in welds with good mechanical properties. Austenitic stainless steels are regarded as having good weldability as they can be welded in a wide range of section thicknesses. Ferritic steels are less so as they can only be welded in thin sections. Duplex steels can be welded with care required in selection of welding consumables and control of welding parameters. Martensitic steels are not easily welded and often need pre-heating and post-weld heat treatment. Low carbon martensitic steels have been developed to avoid pre and or post heating.
Weld Decay	Equivalent to intergranular corrosion . So called because early high carbon stainless steels were found to corrode near welds due to chromium carbide precipitation.
Work Hardening	The property of inducing increased strength to a material as it is being deformed. Also called cold working or temper rolling . Austenitic stainless steels have a high degree of work hardening.
Young's Modulus	The ration of stress to strain on the straight line portion of a stress-strain curve in a tensile test. Does not change much with grade.