14NiCr14, 15NiCr13, 1.5752, 3310 - Special steels Datasheet

14NiCr14 is a low alloy steel that belongs to the group of nickel-chromium steels. It is a case-hardening steel with a high hardenability, meaning it can be hardened through the addition of carbon and other alloying elements. The chemical composition of 14NiCr14 typically includes around 0.14% carbon, 1.3% nickel, 1.5% chromium, and small amounts of other elements such as manganese, silicon, and sulfur.

This type of steel is commonly used in the manufacturing of gears, shafts, and other components that require high strength and wear resistance. Its combination of toughness and hardenability makes it suitable for applications where high surface hardness and core strength are required, such as in the automotive and machinery industries.

14NiCr14 steel is commonly used in applications that require high strength, toughness, and wear resistance. Some common applications include:

- Gear manufacturing: 14NiCr14 steel is often used for the production of gears, especially in automotive and machinery industries. It offers excellent wear resistance and high fatigue strength, making it suitable for heavy-duty gear applications.
- Shafts and axles: Due to its high tensile strength, 14NiCr14 steel is commonly used in the manufacture of shafts and axles, particularly in applications that require high load-bearing capacity and resistance to bending or torsional stresses.
- Crankshafts: This steel grade is also used in the production of crankshafts, which are critical components in internal combustion engines. 14NiCr14 offers good fatigue resistance and high hardness, making it suitable for withstanding the dynamic loads and stresses experienced by crankshafts.
- Machine parts: 14NiCr14 steel is utilized in various machine parts, such as gears, sprockets, and bearings. Its combination of toughness, wear resistance, and strength make it suitable for applications that involve high stress and friction.
- Automotive components: The steel grade is commonly used in the automotive industry for parts like gearboxes, transmission components, and drive shafts. Its properties make it well-suited for withstanding heavy loads, impacts, and wear in these applications.

Overall, the 14NiCr14 steel is utilized in applications that require high strength, toughness, and wear resistance, particularly in industries such as automotive, machinery, and general engineering.

Chemical Composition

Grade	Chemical composition WT %						
	C	Si	Mn	P	S	Cr	Ni
14NiCr14	0.14-0.2	max 0.40	0.40-0.70	max 0.030	max 0.030	0.60-1.00	3.00-3.50
15NiCr13, 1.5752	0.14-0.2	max 0.40	0.40-0.70	max 0.025	max 0.030	0.60-0.90	3.00-3.50

BS 655M13	0.14-0.2	max 0.40	0.40-0.70	max 0.025	max 0.030	0.60-0.90	3.00-3.50

Mechanical Properties

- Tensile strength: The tensile strength of 14NiCr14 steel is typically around 1000-1200 MPa (MegaPascals), which indicates its ability to withstand pulling or stretching forces.
- Yield strength: The yield strength of this steel grade is approximately 800-1000 MPa. Yield strength refers to the stress at which a material begins to deform permanently.
- Elongation: 14NiCr14 steel has a moderate elongation capability, typically ranging from 10% to 15%. Elongation represents the percentage increase in length of a material before it fractures under tension.
- Hardness: The hardness of 14NiCr14 steel is usually in the range of 260-320 HB (Brinell hardness). This indicates its resistance to indentation or penetration by another material.
- Impact toughness: This steel grade exhibits good impact toughness, which means it can withstand sudden or high-velocity loads without fracturing. The impact toughness is typically around 15-25 Joules/cm².

It's important to note that these mechanical properties may vary slightly depending on the specific manufacturing process and heat treatment applied to the steel. It's recommended to consult the manufacturer's data sheet or relevant standards for precise mechanical property values.

Physical Properties

- Density: The density of 14NiCr14 steel is typically around 7.85 g/cm³. Density is the mass per unit volume of a material and is often used to determine its weight or buoyancy.
- Melting point: The melting point of this steel grade is approximately 1420-1460°C (2590-2660°F). This is the temperature at which the solid steel transforms into a liquid state.
- Thermal conductivity: The thermal conductivity of 14NiCr14 steel is about 44.7 W/m·K. Thermal conductivity measures a material's ability to conduct heat and is important in applications where heat transfer is a factor.
- Electrical conductivity: The electrical conductivity of this steel grade is relatively low, as it is primarily used for its mechanical properties rather than electrical conductivity.
- Coefficient of thermal expansion: The coefficient of thermal expansion for 14NiCr14 steel is typically around 12-14 x 10^-6/°C. This indicates how much the material will expand or contract in response to changes in temperature.

It's important to note that these physical properties are approximate values and can vary slightly depending on the specific composition and manufacturing process used for the steel. It's recommended to consult the manufacturer's data sheet or relevant standards for precise physical property values.

Heat Treatment

The heat treatment of 14NiCr14 steel is typically carried out to enhance its mechanical properties and improve its performance in specific applications. Common heat

treatment processes for this steel grade include:

- Annealing: Annealing involves heating the steel to a specific temperature (typically around 800-850°C) and holding it there for a sufficient amount of time, followed by slow cooling. This process helps to relieve internal stresses, improve machinability, and refine the microstructure of the steel.
- Normalizing: Normalizing is a heat treatment process similar to annealing, but with a faster cooling rate. The steel is heated to a temperature above the transformation range (typically around 900-950°C) and then air-cooled. Normalizing helps to refine the grain structure, improve the mechanical properties, and increase the hardness of the steel.
- Quenching and tempering: This is a two-step heat treatment process that involves rapid cooling (quenching) and subsequent reheating (tempering). The steel is heated to a temperature above the transformation range and then quenched in a suitable cooling medium such as oil, water, or polymer. This rapid cooling results in a hardened structure with increased strength and hardness. The quenched steel is then tempered by reheating it to a temperature generally between 150-300°C, depending on the desired properties. Tempering helps to reduce the brittleness caused by the quenching process and improve the toughness and ductility of the steel.

It's important to note that specific heat treatment parameters, such as heating and cooling rates, time at temperature, and tempering temperature, can vary depending on the desired properties and the specific application requirements. It's recommended to consult the manufacturer's guidelines or relevant standards for precise heat treatment instructions.

Welding Properties

14NiCr14 steel is a low alloy case-hardening steel that is commonly used in the manufacturing of gears, shafts, and other high-stress components. When it comes to welding 14NiCr14 steel, there are a few considerations to keep in mind:

1. Preheating: Preheating the steel before welding can help reduce the risk of cracking and improve the weldability of the material. The recommended preheating temperature for 14NiCr14 steel is typically around 200-300°C.

2. Welding process: TIG (Tungsten Inert Gas) welding or MIG (Metal Inert Gas) welding methods are commonly used for welding 14NiCr14 steel. These processes provide good control over heat input and allow for precise welding.

3. Welding consumables: When selecting welding consumables, it is important to choose ones that are compatible with the base metal. Generally, low alloy steel filler materials, such as AWS A5.5 E8018-B2 or E9018-B3 electrodes, are suitable for welding 14NiCr14 steel.

4. Post-weld heat treatment: After welding, it is recommended to perform a post-weld heat treatment (PWHT) to relieve residual stresses and improve the toughness of the weld. The exact PWHT requirements will depend on the specific application and desired mechanical properties.

5. Welding precautions: When welding 14NiCr14 steel, it is crucial to clean the base metal thoroughly to remove any contaminants, such as oil, grease, or rust, that could affect the quality of the weld. Additionally, proper joint preparation, including beveling or chamfering the edges, can help ensure a strong and secure weld.
As always, it is important to consult the manufacturer's guidelines and work with a qualified welder or welding engineer to ensure proper procedures are followed for welding 14NiCr14 steel.

Machining Properties

When it comes to machining 14NiCr14 steel, there are a few considerations to keep in mind:

1. Tooling: Use cutting tools made from high-speed steel (HSS) or carbide for machining 14NiCr14 steel. These materials are known for their hardness and heat resistance, which are important when machining tough and heat-resistant materials like 14NiCr14 steel.

2. Cutting speed: Use a low to moderate cutting speed to prevent excessive heat buildup and tool wear. The specific cutting speed will depend on the tool material, workpiece hardness, and machining process (e.g., turning, milling, drilling). Consult the tool manufacturer's recommendations or machining handbooks for the appropriate cutting speed.

3. Feed rate and depth of cut: Optimize the feed rate and depth of cut to achieve a balance between material removal rate and tool life. Start with conservative feed rates and depths of cut, and adjust as needed based on the specific machining operation and tool performance.

4. Coolant or lubrication: Use coolant or lubrication during machining to reduce heat generation and facilitate chip evacuation. This is especially important when performing heavy cuts or continuous machining operations.

5. Workpiece stability: Ensure that the workpiece is securely clamped or supported to minimize vibration and chatter during machining. Stable workpiece setup is essential for achieving accurate and high-quality machined surfaces. 6. Post-machining treatment: After machining, it may be necessary to perform post-process treatments, such as heat treatment or surface finishing, to achieve the desired mechanical properties or surface quality. As always, it is important to consult the manufacturer's guidelines and work with experienced machinists or machining engineers for the best practices and recommendations specific to 14NiCr14 steel machining.

Similar or Equivalents Steel Grade

Some similar grades to 14NiCr14 steel include:

1. 16NiCr4: This steel grade is also a low alloy case-hardening steel with similar composition and properties to 14NiCr14.

2. 18NiCrMo5: Another low alloy case-hardening steel, 18NiCrMo5 has a slightly higher nickel content compared to 14NiCr14 and offers good toughness and wear resistance.

3. 20NiCrMo2: This steel grade has a higher carbon content compared to 14NiCr14, which provides improved hardenability and strength.

4. 20NiCrMoS2: Similar to 20NiCrMo2, this grade has the addition of sulfur for improved machinability, but it can slightly reduce the toughness compared to 20NiCrMo2.

5. 16NiCrS4: This steel grade is a sulfurized version of 16NiCr4, offering improved machinability but slightly reduced toughness compared to the non-sulfurized grade.

It's important to note that while these grades are similar to 14NiCr14 in terms of composition and properties, there may be variations in specific mechanical properties or heat treatment requirements. Therefore, it is advisable to consult the manufacturer's recommendations or technical specifications for each specific grade to ensure proper selection and usage.