30CRMOV9, 1.7707

31CrMoV9 steel is a low alloy steel that belongs to the EN 10269 standard. It is a chrome-molybdenum-vanadium steel with good toughness, high tensile strength, and excellent heat resistance. This steel is primarily used in the automotive and machinery industries for applications such as gears, crankshafts, and axles. It can be hardened by heat treatment to improve its mechanical properties.

Chemical Composition

Grade	Chemical Composition WT %									
	C	Mn	Si	P	S	Cr	Ni	Mo	V	Cu
31CrMoV9, 1.8519	0.27 - 0.34	0.4 - 0.7	max. 0.40	max. 0.025	max. 0.035	2.3 - 2.7	-	0.15 - 0.25	0.1 - 0.2	-
30CrMoV9, 1.7707	0.26 - 0.34	0.4 - 0.7	max. 0.40	max. 0.035	max. 0.035	2.3 - 2.7	max. 0.6	0.15 - 0.25	0.1 - 0.2	-
30Ch3MF, 30Х3МФ	0.27 - 0.34	0.3 - 0.6	0.17 - 0.37	max. 0.035	max. 0.035	2.3 - 2.7	max. 0.3	0.2 - 0.3	0.06 - 0.12	max. 0.3

Mechanical Properties

- Mechanical Properties:
  - Tensile Strength: 800-1000 MPa
  - Yield Strength: 600-800 MPa
  - Elongation: min 12%
  - Impact Toughness (Charpy V-notch): min 40 J at -20°C

The mechanical properties of 30CrMoV9 steel (similar to 31CrMoV9) can vary depending on the heat treatment and processing conditions. However, here are some typical mechanical properties for this grade:

1. Tensile strength: The tensile strength of 30CrMoV9 steel can range from 800 MPa to 1000 MPa.
2. Yield strength: The yield strength of this grade is typically around 650 MPa.
3. Elongation: The elongation at break for 30CrMoV9 steel is usually between 13% and 18%.
4. Impact toughness: The impact toughness of this grade can be around 20 Joules at room temperature.
5. Hardness: The hardness of 30CrMoV9 steel is typically in the range of 220 to 250 HB.

It is important to note that these values are approximate and can vary depending on the specific heat treatment and processing conditions used. It is always recommended to consult the manufacturer's datasheet or conduct specific testing to obtain accurate mechanical properties for a particular batch of steel.

Physical Properties

The physical properties of 31CrMoV9 steel include:

- Density: 7.83 g/cm3
- Melting Point: 1420-1460°C

- Thermal Conductivity: 41.9 W/m·K
- Specific Heat Capacity: 0.46 J/g·K
- Electrical Resistivity: 0.20-0.25 μΩ·m
- Magnetic Properties: 31CrMoV9 steel is not strongly magnetic.

These properties are typical values and may vary slightly depending on the specific composition and heat treatment of the steel.

Heat Treatment

- Heat Treatment:
  - Quenching: 860-880°C (air or oil)
  - Tempering: 580-680°C (water or oil)

Thermal Properties

The thermal properties of 31CrMoV9 steel include: Thermal Conductivity: 33 W/m·K Coefficient of Thermal Expansion: 11.7 x 10^-6 /°C (20-100°C) Specific Heat Capacity: 0.46 J/g·K These values indicate the steel's ability to conduct heat, expand with temperature changes, and store heat energy. It is important to note that these properties can vary depending on the specific composition and heat treatment of the steel.

Welding Properties

31CrMoV9 steel can be welded using various welding processes, such as: Shielded Metal Arc Welding (SMAW): This process, also known as stick welding, is commonly used for welding 31CrMoV9 steel. It involves using a consumable electrode coated in flux, which creates a protective shield around the weld pool. Gas Metal Arc Welding (GMAW): This process, also known as MIG/MAG welding, is suitable for welding 31CrMoV9 steel. It utilizes a continuous wire electrode and a shielding gas to protect the weld pool from atmospheric contamination. Gas Tungsten Arc Welding (GTAW): This process, also known as TIG welding, can be used for welding 31CrMoV9 steel. It requires a non-consumable tungsten electrode and an inert shielding gas to protect the weld area. Flux-Cored Arc Welding (FCAW): This process can be employed for welding 31CrMoV9 steel, using a tubular electrode filled with flux. It can be performed with or without shielding gas, depending on the specific flux-cored wire used. During welding, it is essential to take precautions to prevent the formation of hydrogen-induced cracking. Preheating the steel and using low hydrogen welding consumables can help minimize the risk of cracking. Post-weld heat treatment may also be necessary to relieve residual stresses and improve the weld's mechanical properties. It is crucial to follow the specific welding procedures recommended by the steel manufacturer or consult with a qualified welding engineer to ensure proper welding of 31CrMoV9 steel.

Machining Properties

31CrMoV9 steel can be machined using conventional machining processes. Some common machining operations that can be performed on 31CrMoV9 steel include turning, milling, drilling, and tapping. However, as 31CrMoV9 is a high-strength alloy steel, it can pose some challenges during machining.Here are some general guidelines to consider when machining

31CrMoV9 steel:Tooling: Use high-speed steel (HSS) or carbide cutting tools with appropriate coatings for improved tool life. Tools with sharp cutting edges and rigid setups are recommended.Cutting Speed: Optimize the cutting speed based on the specific tooling and machining operation. Start with lower speeds and gradually increase to find the optimal cutting speed for the material and tooling being used.Feed Rates: Use moderate to high feed rates to achieve efficient material removal. However, avoid excessive feed rates that can cause tool wear or chip formation issues.Cutting Fluid: Apply a suitable cutting fluid or coolant during machining to lubricate the cutting tool and flush away chips. This helps to prevent overheating and prolong tool life.Heat Management: Due to the high strength and heat sensitivity of 31CrMoV9 steel, it is important to manage heat generation during machining. Minimize dwell time, avoid excessive heat buildup, and use peck drilling techniques when drilling deep holes.Workholding: Secure the workpiece firmly in place to avoid vibration or chatter during machining. This ensures dimensional accuracy and surface finish.Post-Machining: After machining, the machined surfaces may require deburring or additional surface treatment processes, such as grinding or polishing, to achieve the desired finish.It is recommended to consult with the steel manufacturer or a machining expert for specific machining parameters and techniques suitable for 31CrMoV9 steel. Additionally, proper safety measures should always be followed when handling and machining any type of steel.