



HSF – High-performance tool steel for high speed/warm forging dies

Wiehl, 05.12.2019

High-speed forging – up to 200 parts/min



- With high-speed forging a rate of up to 200 parts/min is possible
- Because of watercooling high thermal alternating strain of the tools
- Tools are subjected to heavy wear and thermal fatigue
- On high-speed forging presses mostly rotationally symmetric components such as bevel gears or bearing shells are produced
- High-speed forging meets market demands for large series

Process parameters	Loads on tools	Requirements
<ul style="list-style-type: none"> • High forging rate • Short contact time 	<ul style="list-style-type: none"> • Strong sudden mechanical load 	<ul style="list-style-type: none"> • Excellent toughness
<ul style="list-style-type: none"> • High quantities 	<ul style="list-style-type: none"> • Strong abrasive wear 	<ul style="list-style-type: none"> • High wear resistance
<ul style="list-style-type: none"> • High forging temperature with simultaneous strong cooling 	<ul style="list-style-type: none"> • High thermal alternating strain 	<ul style="list-style-type: none"> • Tempering resistance and thermal shock resistance

Warm forming combines the advantages of cold and hot forming



- High form changes + high accuracy of shape and dimensions
- Working temperature between 600 °C and 950 °C
- Long contact time between forging part and forging die
- Higher mechanical load on the dies due to higher forming forces

Process parameters	Loads on tools	Requirements
<ul style="list-style-type: none"> • Slow forging process • Long contact time 	<ul style="list-style-type: none"> • High thermal load 	<ul style="list-style-type: none"> • Tempering resistance
<ul style="list-style-type: none"> • Higher forming forces 	<ul style="list-style-type: none"> • High mechanical load 	<ul style="list-style-type: none"> • High toughness
<ul style="list-style-type: none"> • Lower forming temperature 	<ul style="list-style-type: none"> • Strong abrasive wear 	<ul style="list-style-type: none"> • High wear resistance

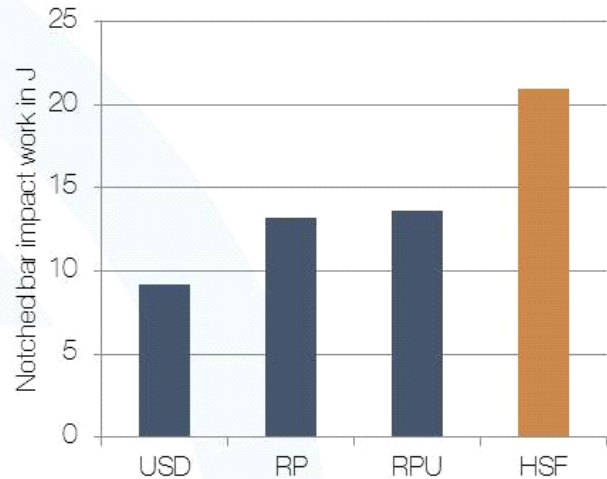
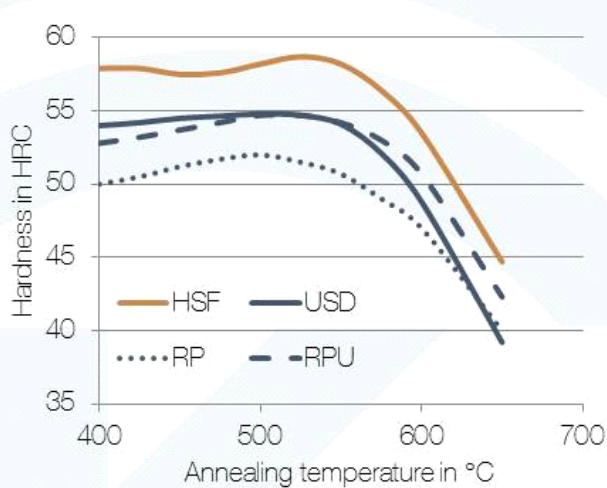
HSF provides an tailored alloying concept for strongest performance

HSF - 5% chromium steel with reduced content of silicon

- HSF is tailored to high toughness, high-temperature strength and thermal shock resistance
- Adjusted alloying concept enables higher hardness with high toughness at once
- Pre-sorted scrap selection ensures high purity even without ESR
- Increasing the toughness by lowering Si content
- Alloying with niobium increases the austenitizing temperature, resulting in higher hardness

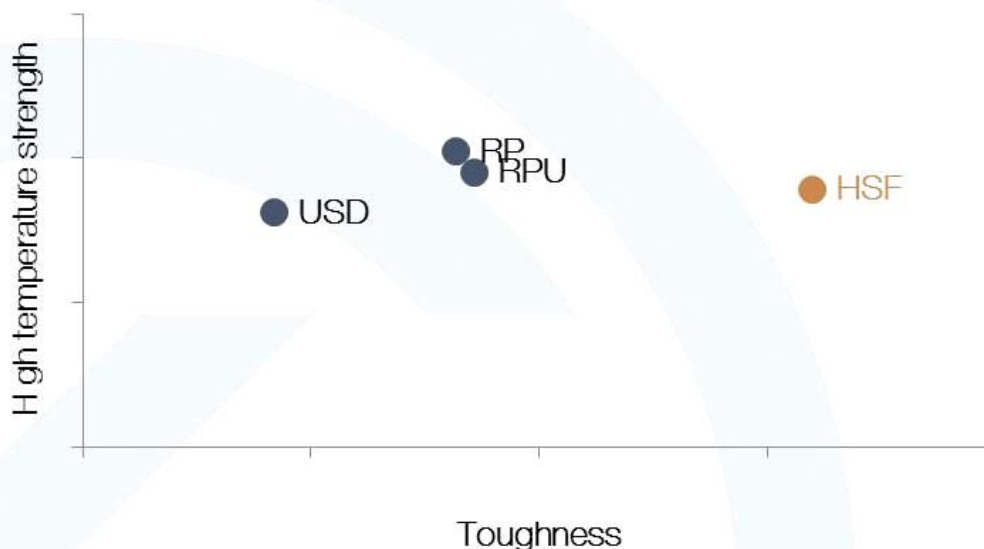
Density g/cm ³	Coefficient of thermal expansion 10 ⁻⁶ m/mK			Thermal conductivity W/mK			
	20-100°C	20-400°C	20-600°C	20°C	200°C	400°C	
20°C	7,79	11,8	13,2	13,4	28,8	30,0	29,4

HSF offers improved tempering resistance and high toughness



- HSF offers a higher tempering resistance than the standard grades USD, RP and RPU
- HSF convinces with significantly higher toughness than the standard grades
- Hardness: 52 HRC
- Sample shape: ISO-V, 55x10x10mm³
- Sample position: transversely, transition zone
- quenched + tempered in laboratory

HSF combines high high temperature strength with high toughness at the same time



- High temperature strength – HSF is on par with the very high heat resistant RP
- HSF convinces with a much higher toughness at the same time