



High-performance tool steel for forging tools

HSF

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Many tools in the die forging industry are subjected to high tool wear. The premium tool steel HSF extends the lifetime of the tool:

- Outstanding hot wear resistance
- Working hardness in the range up to 56 - 58 HRC
- High tempering resistance
- Excellent heat resistance
- High thermal shock resistance
- Very good toughness



Kind&Co

For over 130 years, we have been producing high-quality tool steel exclusively at our site in Bielstein. Kind&Co is still a family owned business today. We stand for sophisticated material solutions, highest quality, reliable service and competent advice - tailored to the respective application. We have particularly strong application expertise in the areas of die casting, extrusion and die forging.



Die forging requirements

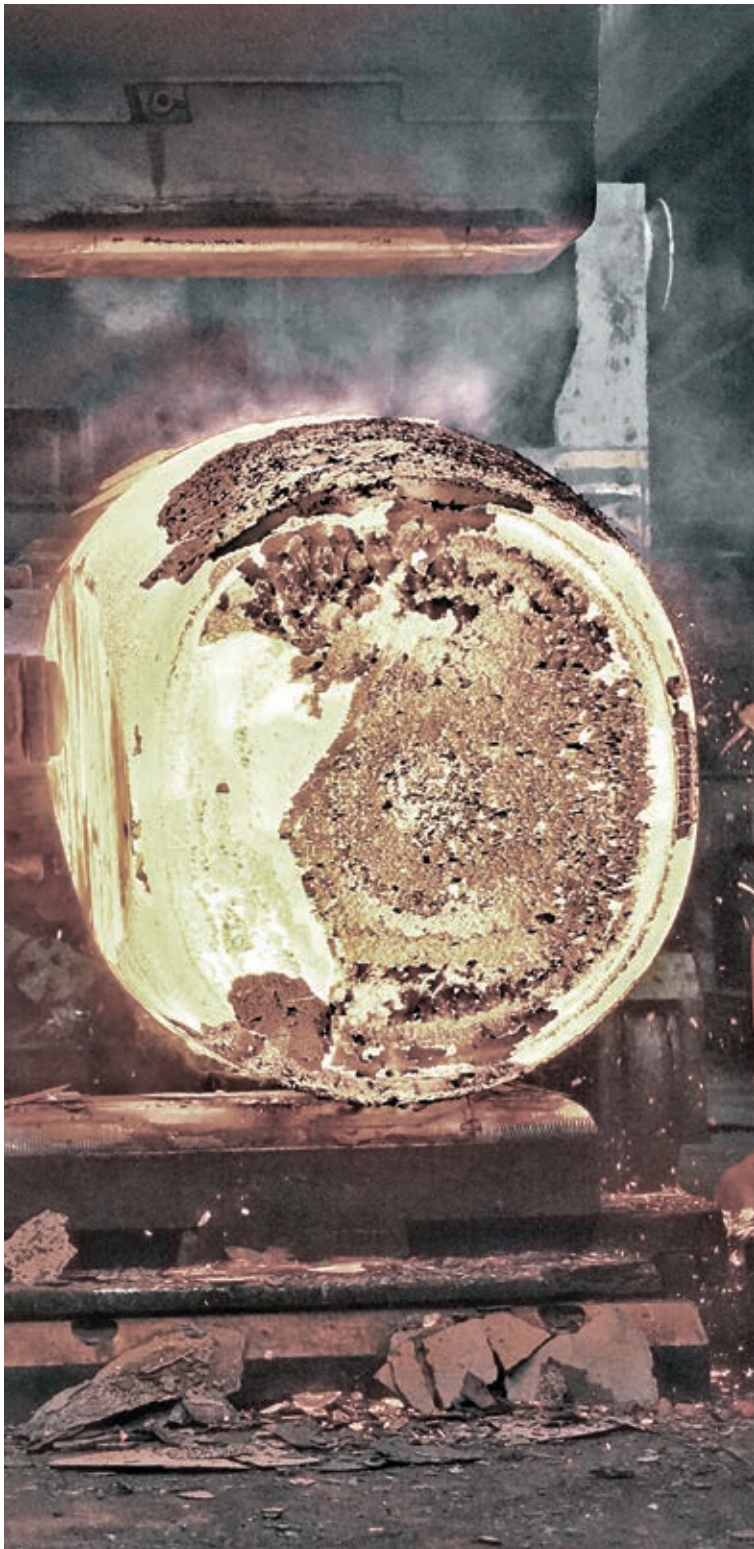
Die forging is used to produce a variety of precision forged parts. Especially in fully automatic forging, on high-speed forging presses and in warm forging, the tools are exposed to extremely high working temperatures and very high loads.

Many tools fail due to premature loss of hardness. This leads to deformation of the die and thus to insufficient dimensional accuracy of the product to be forged. In addition, high mechanical stresses lead to heavy wear of the engraving.

The usual and necessary intensive cooling during forging on high-speed forging presses is intended to avoid tool overheating and early tempering effects. Unfortunately this introduces high stresses into the dies, which can lead to thermal shock cracks.

In warm and precision forging, products with complex geometries are manufactured which place high demands on the dies. Long contact times and high mechanical loads require a combination of high wear resistance and high toughness.

The use of tool steels with excellent high-temperature strength and high toughness at elevated temperature can considerably extend the lifetime of the tools, as tempering effects occur more slowly and existing hot cracks propagate later. During this process, the high hardness of the used tool steel offers a reduction of wear. Consequently the lifetime of the die is increased, the maintenance is reduced and the quality of the final product is improved.



Material properties HSF

HSF is a Cr-Mo-V alloyed hot-work tool steel with the advantage of high hardness and very good wear resistance. Optimal alloying concept and special treatment guarantee high toughness properties at the same time.

Application

- Tools in fully automatic horizontal high-speed forging presses
- Punches, forging dies and extrusion dies in the warm forming of steels
- Hot extrusion dies for steel forming
- Forging dies with flat engravings with high demands on hot wear resistance
- Hot punches and shearing tools

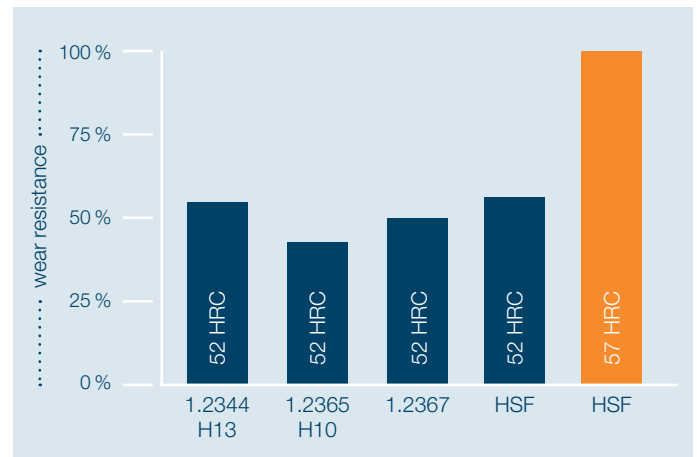


Comparison of properties

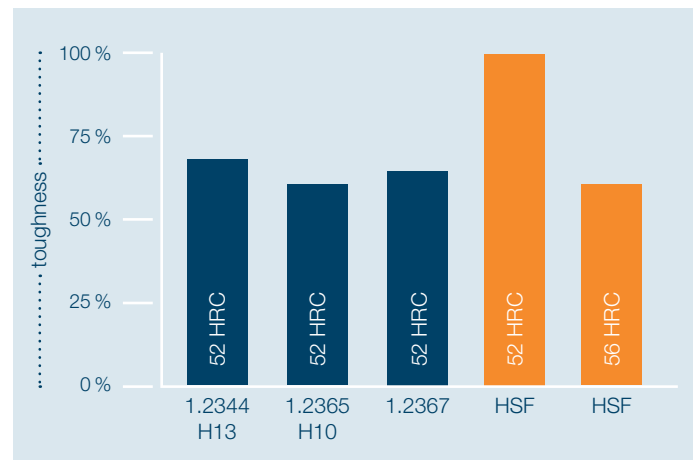
Forging tools, failure patterns ▼



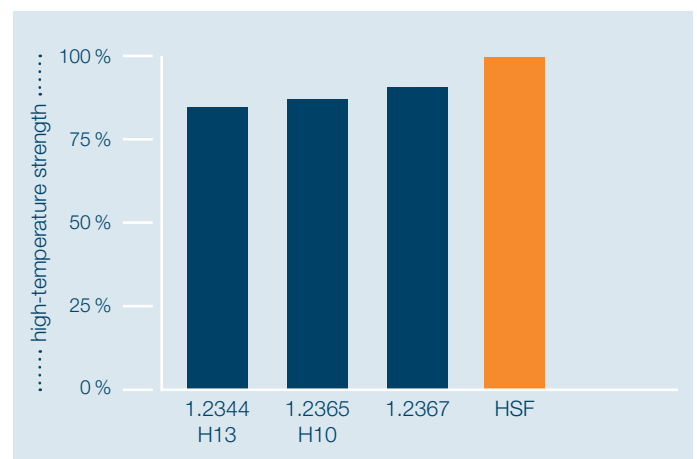
Comparison of wear resistance



Comparison of toughness



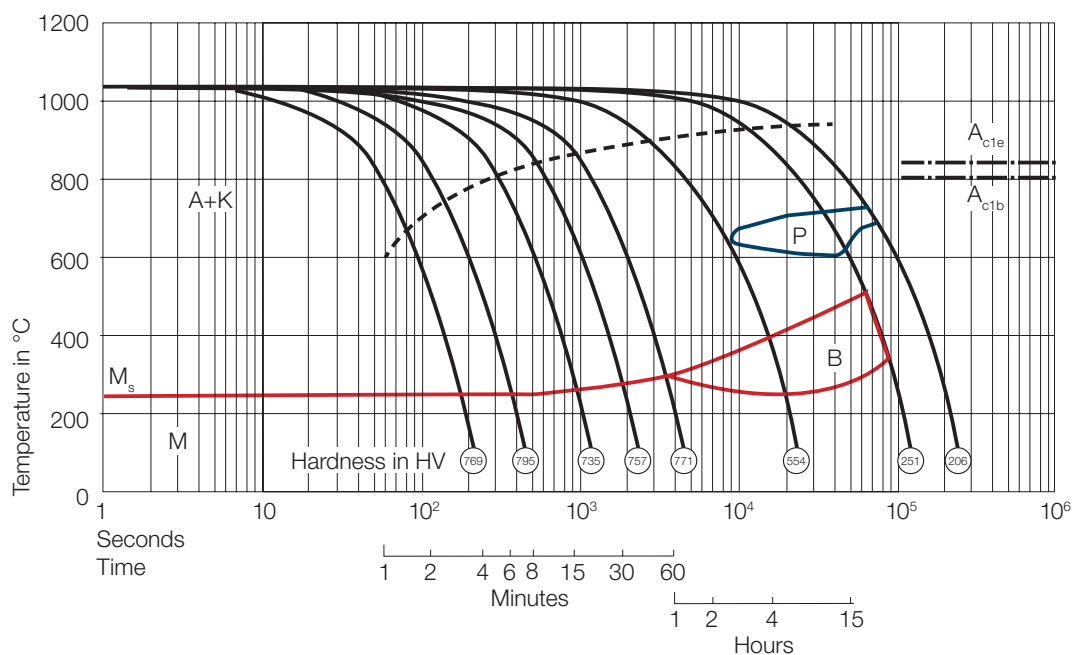
Comparison of high-temperature strength





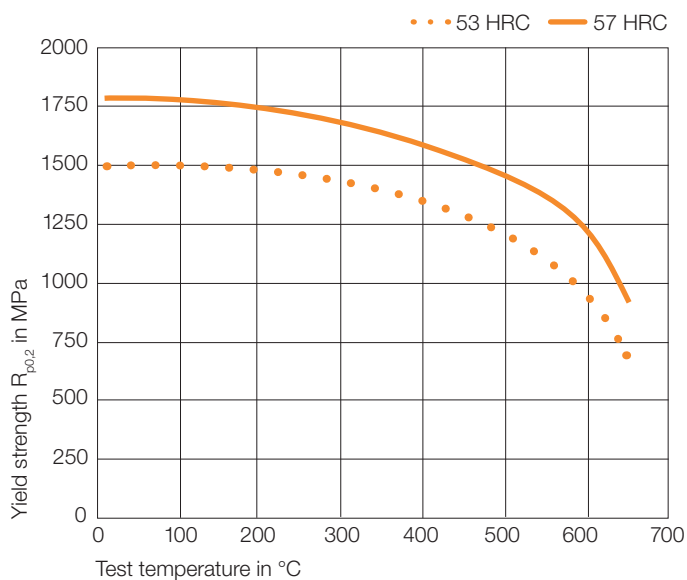
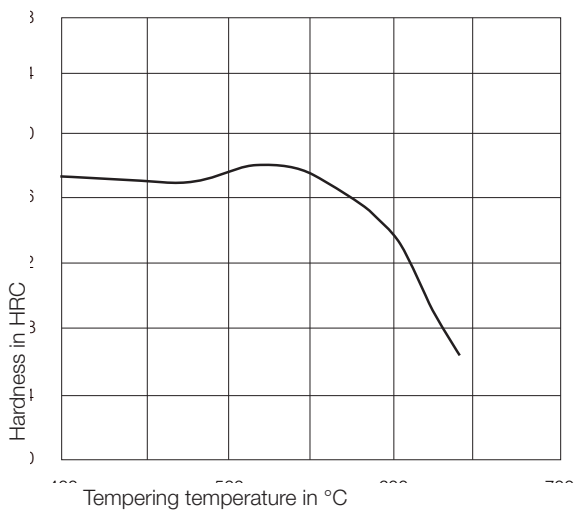
Continuous time-temperature-transformation graph

Austenitizing temperature 1030 °C



Tempering graph

Yield strength at elevated temperature



Physical properties

Temperature in °C	20 - 100	20 - 200	20 - 400	20 - 600
Thermal expansion in 10 ⁻⁶ m/m x K	11,8	12,5	13,2	13,4
Temperature in °C	20	200	400	
Thermal conductivity in W/m x K	28,8	30,0	29,4	
Temperature in °C	20			
Density in g/cm ³	7,79			
Temperature in °C	20			
Young's Modulus in GPa	213			

Production processes

Melting

Forging

Heat treatment

Mechanical processing

Vacuum hardening

Surface treatment

Products

Hot-work tool steels

Cold-work tool steels

Die forging steels

Plastic mould steels

Industries

Die casting

Extrusion

Die forging

Pipe technology

Plastics technology

Hot-stamping

Special applications

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