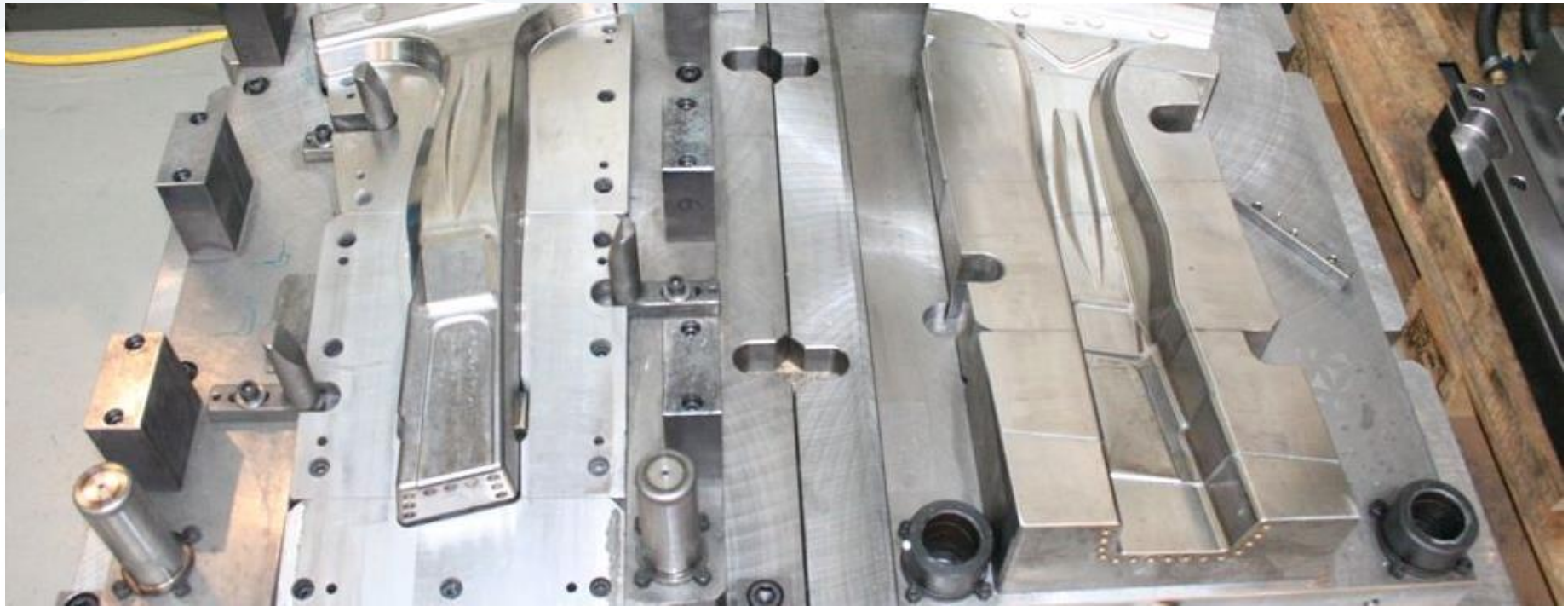




# UH1 - The new premium steel for hot stamping tools

Wiehl, October 8, 2019

# UH1: Higher hardness, more wear resistance for hot stamping



- The economic pressure in producing press-hardened body components calls for tool steels with improved wear resistance.
- The wear resistance of such a steel is determined on the one hand by its hardness, on the other hand by its carbide content.
- In the development of a tool steel for hot stamping tools with increased wear resistance, special attention must be paid to the thermal conductivity.
- The composition of the new UH1 steel was tailor-made to these requirements



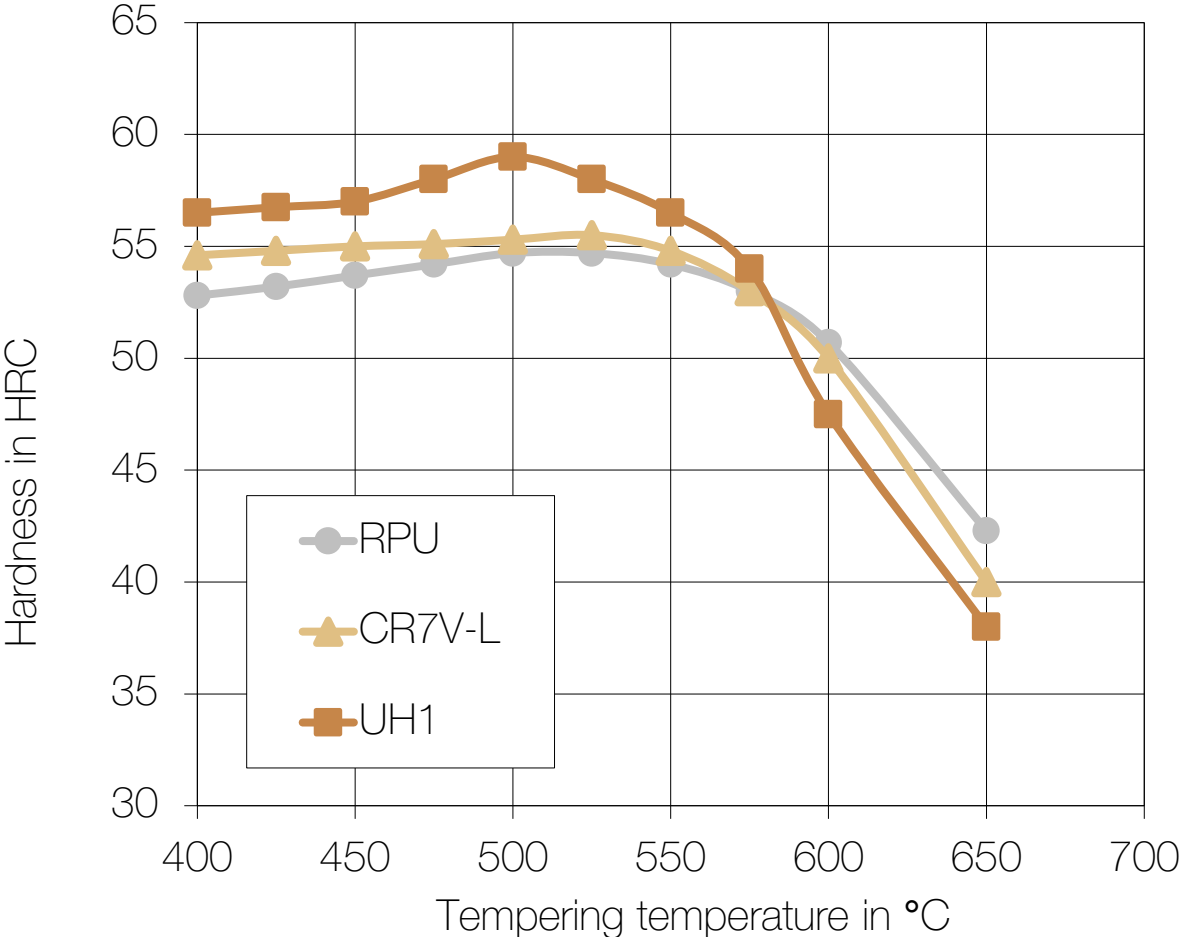
# UH1 and Cr7V-L exhibit an excellent property combination of properties for hot stamping

Denomination		Alloy content in mass-%						Hardness recommendation
Brand name	Mat.-Nr.	C	Si	Mn	Cr	Mo	V	HRC
RPU	1.2367	0,38	0,40	0,40	5,00	2,80	0,60	48 – 52 HRC
Cr7V-L	-	0.42	0.50	0.40	6.50	1.30	0.80	50 – 56 HRC
UH1	-	0,46	0,45	0,50	6,70	1,50	0,80	52 – 58 HRC

- Good standard: RPU has a standardized analysis concept, but the execution at Kind&Co (metallurgy, forging strategy, heat treatment, etc.) is excellent.
- Premium: Cr7V-L is a proprietary development by Kind&Co. The combination of properties of Cr7V-L is specially tailored to the requirements of hot stamping.
- Premium grade UH1: The proportion of carbide-forming alloying elements (C, Cr, Mo and V) has been further increased to increase the hardness and wear resistance of Cr7V-L. By using electro-slag remelting metallurgy (ESR), the steel achieves a significantly improved level of macro and micro cleanliness.

# Higher level of hardness attainable with UH1

## Tempering curves



- UH1 achieves a significantly higher maximum hardness

● Good Standard  
■ ▲ Premium

# Wear tests on steels for hot stamping – experimental setup



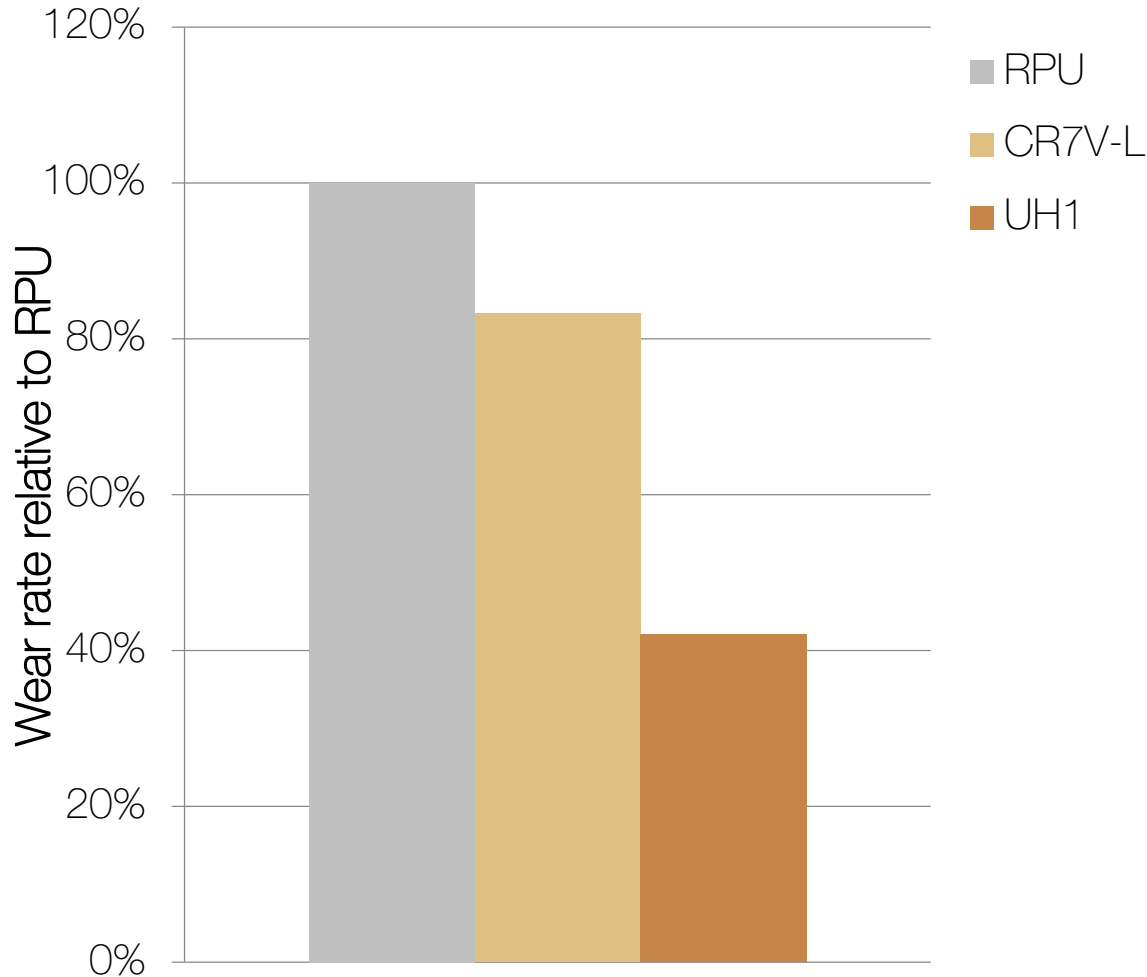
## Test parameters „pin on disc“ method

Temperature	20 °C
Ball	Al <sub>2</sub> O <sub>3</sub>
Contact force	5 N
Rotational speed	25 mm/s
Path length	2000 m

- Tested materials: RPU, Cr7V-L, UH1
- For the experiments in each run 3 samples with a hardness of 56 HRC were used.
- The scratch groove (depth, width) was determined by profilometer measurement.

# UH1 shows excellent wear resistance – more than double compared to a standard steel

## Wear rate comparison



- The significantly lower wear rate of the new steel UH1 illustrates its significantly improved wear resistance compared to Cr7V-L and RPU.
- The higher carbide content of UH1 contributes to the higher wear resistance, even at the same working hardness.

# The improved wear resistance of UH1 has no negative effects on thermal conductivity

Brand name	Density g/cm <sup>3</sup>	Thermal expansion coefficient 10 <sup>-6</sup> m/mK				Thermal conductivity W/mK		
	23°C	20-100°C	20-200°C	20-400°C	20-600°C	23°C	200°C	400°C
RPU	7,85	11,9	12,5	12,8	13,3	29,9	32,1	32,4
Cr7V-L	7,79	11,4	11,9	12,5	13,1	26,7	29,8	30,8
UH1	7,79	11,0	11,6	12,2	12,7	25,0	28,2	29,0

- The evolution of the Cr7V-L into UH1 has not changed the essential physical properties.
- The thermal conductivity, essential for the efficiency of hot stamping, has not been significantly changed.
- The discernible differences lie in the magnitude of the measurement accuracy of the test methods used.

To set optimum properties, tools made of UH1 require hardening tailored to the chemical composition of the steel.

Kind&Co recommends the following parameters:

- Hardening temperature: 1050 ° C
- Holding time: 45 minutes.

The vacuum hardening department of Kind&Co is optimally equipped for the proper heat treatment of tools made of UH1.