

**ROVALMA**

THE STEEL INNOVATOR



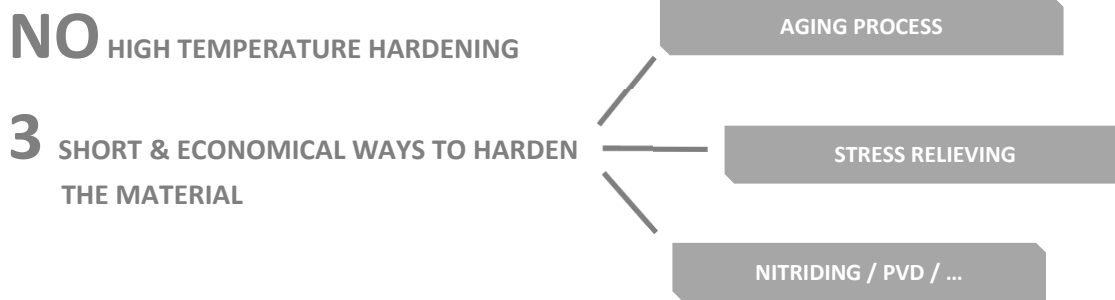
HTCS<sup>®</sup>-233

The New Way of Making Tools

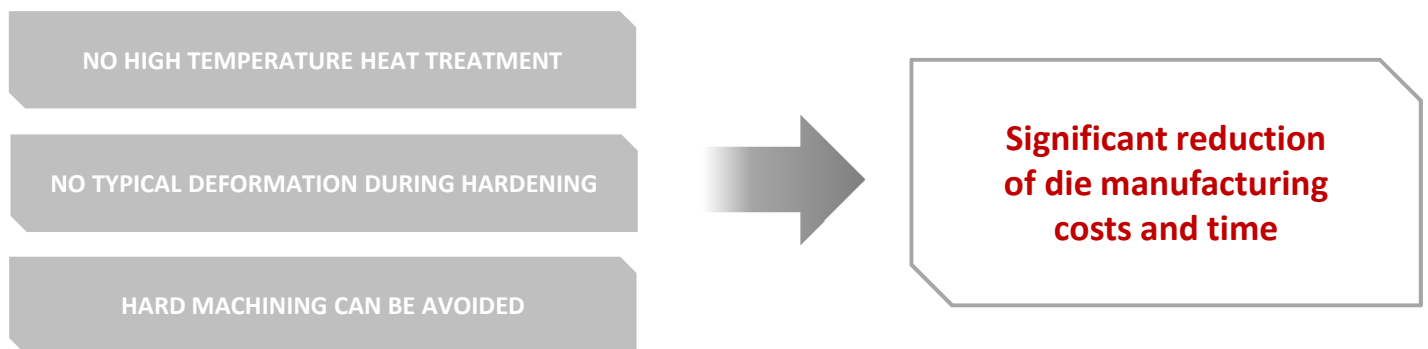
# HTCS<sup>®</sup>-233

HTCS<sup>®</sup>-233 hot work tool steel has been designed for making tools, dies and moulds for applications benefiting from high thermal conductivity while requiring high mechanical strength and hardness of >50 HRC, such as fiber glass reinforced plastic injection moulding processes, and hot stamping processes. The high Thermal conductivity of HTCS<sup>®</sup>-233 allows to increase the cooling rate, shorten the cycle time and improve the quality of the produced part. HTCS<sup>®</sup>-233 offers also great opportunities to considerably reduce tool manufacturing costs and lead time to production, as the long and expensive conventional process of hardening plus tempering cycles has been eliminated with this material, along with the necessity for finish machining in hardened state.

## Revolution in Heat Treatment



The new high performance hot work tool steel HTCS<sup>®</sup>-233 presents a novel and remarkable feature, which provides a great opportunity to save time and money: compared to the conventional hot work tool steels. HTCS<sup>®</sup>-233 does not need a high temperature heat treatment to achieve high hardness. Instead HTCS<sup>®</sup>-233 can be supplied at a low hardness providing an easy machining of all type of tools and moulds, and thereafter the material only needs to be subjected to a low temperature heat treatment >600°C to be hardened to more than 50 HRC. What might be even more interesting for some applications, the rise in hardness can also be accomplished during a nitriding process or stress relieving tempering cycles.



## Dimensional Stability During the Hardening Process

- Very small uniform material growth during the hardening process of about 0.09 %.
- It is homogeneous in the three dimensions of the block.
- It is always reproducible for a chosen hardening strategy.

➔ Save time and money by **skipping final machining at hardened state.**

## Heat Treatment - Hardenability

During high temperature heat treatment involving quenching, for big cross-sections a gradient in the intensity of cooling is typically generated from the surface to the core of the piece. This quenching gradient often brings along a gradation of microstructures with the corresponding inhomogeneity of mechanical properties. For most hot work tools steels, it is even difficult to attain a high level of hardness in the core when the dimensions of the heat treated piece are big. These problems can be solved with HTCS®-233 material, which can reach hardness of 50-53 HRC with a simple low temperature heat treatment; the hardness and other relevant mechanical properties are then homogeneously distributed from the surface to the core, even for pieces with very large thickness. The heat treatment could be even more optimized according to the tool geometries. We recommend to directly consult with ROVALMA S.A. with regard to optimized heat treatment instructions for a given application or desired combination of properties.

## Polishability

- Unique microstructure features provides high polishability.
- A Polishability level comparable to special tool steels for plastic injection applications, mesh 3.000, is possible.
- For applications requiring a mirror or even better surface finish, HTCS®-230HP is available, with polishability features of: class N0, Ra < 0,0125µm, Rz < 0,06µm, mesh > 11.000.

## Physical and Mechanical Properties

Properties	300 K	423 K	Unit
Density	7.97	7.92	g/cm <sup>3</sup>
Mechanical Resistance	1750	1660	MPa
Yield Strength 0.2 %	1640	1585	MPa
Elastic Modulus	210		GPa

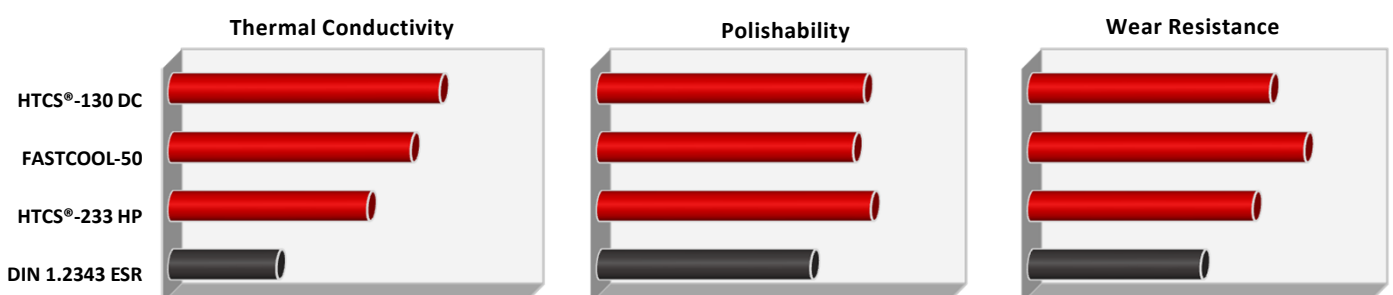
The values given in the tables are typical values (neither maximum nor minimum values), for properly heat treated materials at a typical hardness level of 50-52 HRC.

## Thermal Properties

Properties	300 K	423 K	Unit
Linear Thermal Expansion Coefficient		12	x10 <sup>-6</sup> /K
Thermal Diffusivity	10.9	9.8	mm <sup>2</sup> /s
Thermal Conductivity	41	40	W/m·K
Specific Heat Capacity	0.47	0.51	J/g·K

The values given in the tables are typical values (neither maximum nor minimum values), for properly heat treated materials at a typical hardness level of 50-52 HRC. Thermal conductivity values are calculated on the basis of thermal diffusivity values measured by laser flash.

## Tool Steel Grade General Comparison



# Designer & Provider of First-Class Tool Materials

ROVALMA, S.A. provides innovation in tool materials. Thanks to comprehensive research, innovative design and development, most recent production techniques as well as in depth quality control, we have achieved significant advances in the knowledge about material forming processes and generated important know-how regarding the production and optimal usage of our materials for a specific application. As a result, we can provide you with **first-class tool steels** for cold and hot work material forming processes and outstanding technical assistance.

We are proud to make our High Performance Tool Steels available to you for your specific applications. Do not hesitate to contact us for the latest information.

## Application Engineering Service

In order to fully exploit the advantages and the potentials of ROVALMA's High Performance Tool Steels, we offer our customers the support of our Application Engineering Service. Our highly qualified and dedicated engineers can assist you in selecting the optimized grade for your application and provide you with the corresponding technical recommendations. It is our mission to increase the competitive-advantage of our customers and support them in achieving the highest possible cost-effectiveness.

You can access our service directly by sending an email to: [ae-fast@rovalma.com](mailto:ae-fast@rovalma.com).



ROVALMA, S.A. carries out ongoing research for many applications regarding the usage of the materials here presented. This research often brings along significant advances in the knowledge of a given process and thus important information regarding the best possible usage of the materials for a specific application. We strongly recommend to get in contact with ROVALMA, S.A. for the latest information regarding a specific application.

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