



ROVALMA, S.A.

Tool Steels and Special Alloys.

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Introduction :

ICO-2800 is a maraging steel developed by ROVALMA, S.A., the production of which is limited to the necessities of the company only.

ICO-2800 is a steel that combines very high levels of toughness, hardness and mechanical resistance with all the advantages that result from precipitation hardening as well as from having the structure of a nickel martensite.

Properties :

The remarkable properties of ICO-2800 are : outstandingly high degree of toughness while featuring at the same time very high levels of hardness. Toughness paradoxically even augments at the same time as hardness is increased until 61 HRc.

ICO-2800 is the optimal solution for those applications, which require highest levels of toughness and mechanical resistance as well as elevated degrees of hardness. It is an alloy that shows very little dispersion of values when looking at the mechanical properties of the test samples, a fact that indicates extreme structural uniformity.

Applications :

Slender punches and inserts with high toughness requirements for: cutting, drawing, stamping, bending and injecting whatever material as long as the working temperature on the surface of the piece does not exceed 700 °C. Die inserts to inject plastics under very severe working conditions. Moulds requiring perfect mirror polish. Dies and punches to press powder (sintered pieces). Hot chamber nozzles for injecting Zamak. Hollow axes to transmit big torques at high speed and with little weight.

ICO-2800

Alloy of the "Maraging" type with exceptional levels of mechanical resistance and toughness.

Subjection tooling and high severity springs. Temper screws and endless screws, high power axes and gears for reduced spaces or small mass. For applications, which require highest mechanical resistance and toughness as well as a degree of hardness up to 62 HRC.

Hot work conformation :

Since ICO-2800 has been exposed to a thermo-mechanical treatment, which ought not be manipulated, hot work conformation is not recommended.

Stress relieving :

If the piece needs a stress relieving treatment because it is of a complex geometry, we recommend to consult our technical department on possible solutions.

Precipitation hardening :

Precipitation of ICO-2800 takes place within the temperature range from 480 °C (maintaining this temperature for 6 hours) to 530 °C (holding it at that temperature for 3 hours). A very habitual treatment would be at 520 °C in 3 1/2 hours. No distortions are being produced, only a small, controlled uniform and isotropic contraction takes place; controlled atmosphere to prevent decarburization is not necessary.

Vacuum furnaces are the most adequate for the precipitation hardening of ICO-2800. Resistance furnaces can also be used, although some oxidation occurs. Salt furnaces should not be used, since they deteriorate the surface structure of the piece considerably deep and commonly have a detrimental carburizing effect. In addition to the proper precipitation time, the necessary time for warming up of the piece has to be taken into account, which is 1 min. per mm of thickness, approximately.

Precipitation Table ICO-2800								
Precipitation temperature [°C]	Time [h]	Hardness [HRc]	Resilience 10x10x 55 [J]	Deformation [%]	Tensile Strength [MPa]	Yield strenght 2% def. [MPa]	Elongation [%]	Reduccion of Area [%]
480	6	62	384	28	2520	2412	10.1	34
520	3 1/2	61.5	410	28	2476	2398	10.6	38

Physical and Mechanical Properties

Test temperature [°K]	293	473	573	673	753	Other	Units
Physical constants.							
Coefficient of linear thermal expansion					11.4		$\times 10^{-6} \cdot K^{-1}$
Thermal conductivity	21.8	26.8		28.9			$W \cdot m^{-1} \cdot K^{-1}$
Heat capacity	460.5						$J \cdot Kg^{-1} \cdot K^{-1}$
Density	8.1						$\times 10^3 \cdot Kg \cdot m^{-3}$
Electrical resistivity	50						$\times 10^{-8} \cdot \Omega \cdot m$
Young's modulus	200						GPa
Mechanical properties.							
Tensile strength { 62 HRc }	2520						MPa
Yield strength 2% { 62 HRc }	2412						MPa
Elongation on 50 mm. { 62 HRc }	10.1						%
Reduction of area { 62 HRc }	34						%
Unnotched Charpy [sample : 10x10x55] { 62 HRc }	384						J
Abrasive wear resistance { 62 HRc }	79						ROVALMA-2 coefficient

Surface treatments:

Any nitriding except for salt nitriding (sulphurization etc.) as well as ceramic coatings can be applied. The most appropriate nitriding processes of ICO-2800 are ions and gas plasma. As for ceramic coatings, PVD and CVD are the most adequate. Being ICO-2800 a material, which shows controlled deformation during hardening, CVD could be one of the best solutions. As for both cases – nitriding as much as PVD coating – one should choose the treatment that comes closest to the temperatures and times of the precipitation hardening, since both processes have to be conducted simultaneously.

Soldering, brazing, welding :

ICO-2800 can be joined by any of the up-to-date existing methods including welding. Nevertheless, CO₂ protection baths, electrode-cellulose-coverings and oxyacetylene treatments as well as any other process that could provide carbon should be avoided.

The best welding methods are : TIG, MIG, MAG, electron beam and laser. In any case, the material used for joining has to be ICO-2800 as well.

Machining :

Very tough materials with a very “metal-like” behavior are more difficult to machine through stock-removal than materials that have a brittle structure. In the first case, swarfs have to be cut off, while in the second case, chips can be broken away.

To machine ICO-2800 without having any problems, it is recommendable to use positive rake angle tools like for instance tools used to cut copper, apply slow speed (thus that the chips are white colored) and at fairly high feed rates. Under these conditions, the cutting runs very smooth with very little wearing of the tools. It is recommendable to use tools with lapped faces and very sharp edges, this will help to smooth out the cutting.

General remarks:

Since ICO-2800 is a only recently developed material, most of the field testing are still being conducted. For this reason, it is impossible to provide, at this point of time, comparisons with other materials. So far, we only dispose of two test results with respect to punches for hot work stamping of brass. In these tests, ICO-2800 exceeded the maximum number of pieces produced with tools made of W.Nr.1.2365 at 52 HRc by 22 times and compared with tools made of W.Nr.1.2367 by 20 times.

You can find the most recent actualisation of this technical sheet and other steels on our WebPages.

The information given in these sheets serve the purpose of information about the respective materials analysed. Rovalma, S.A. does not assume any responsibility for individual interpretations made of the information provided.