Zanardi
Fonderie

AUSTEMPERED DUCTILE IRON GRADES FOR WEAR APPLICATIONS

#2

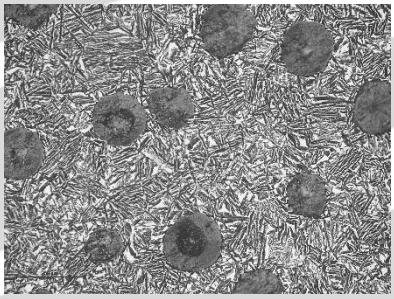
Introduction

This document is designed to familiarize the designer with mechanical properties of **Austempered Ductile Iron grades for wear applications**. It is a reference document, not to be referred to as a standard.
The data in this document are taken from Zanardi research database, international standards, and technical papers. The content of this informational sheet has to be considered "for information only". The real component design shall be based only upon international standards and/or contractual agreements.

1 Material notes

Austempered Ductile Iron (ADI)

Austempered Ductile Iron (ADI) is obtained by heat-treating an alloyed ductile iron, casted with a special preconditioning of the metal bath. The matrix structure consists predominantly of ferrite and acicular austenite. The obtained matrix is called "ausferritic" which offers the combination of high fatigue resistance, toughness, wear resistance, lightness and extensive freedom in designing components together with significant machining properties.



2 Mechanical properties

Static engineering properties

ADI - Minimum values from international standard ISO17804:2020 (separately cast samples).

Tensile test according to standard EN ISO 6892-1:2009, specimen diameter Φ14 mm; Brinell hardness test according to standard EN ISO 6506-1:2014.

Table 1 - Static engineering properties

Reference	**$R_{P\,0,2}$** ***[N/mm²]***			**R_m** ***[N/mm²]***			**A_5** ***[%]***			**HB range** ***Guidance values***
Relevant wall thickness *[mm]*	t ≤ 30	30 < t ≤ 60	60 < t ≤ 100	t ≤ 30	30 < t ≤ 60	60 < t ≤ 100	t ≤ 30	30 < t ≤ 60	60 < t ≤ 100	
JS/1400-1	1100	To be agreed	To be agreed	1400	1170	1140	1	To be agreed	To be agreed	380÷480
JS/HBW400	1100			1400			1			400 min.
JS/HBW450	1300			1600			-			450 min.

Wear properties

Following figures are taken from Zanardi Database, wet pin abrasion test according to standard ASTM G132-96.

Test condition: pin (material to be tested) ϕ 8mm, abrasive disk ZrO P100, water cooling media, mean relative sliding speed 1,05 m/s, load 0,7 MPa.

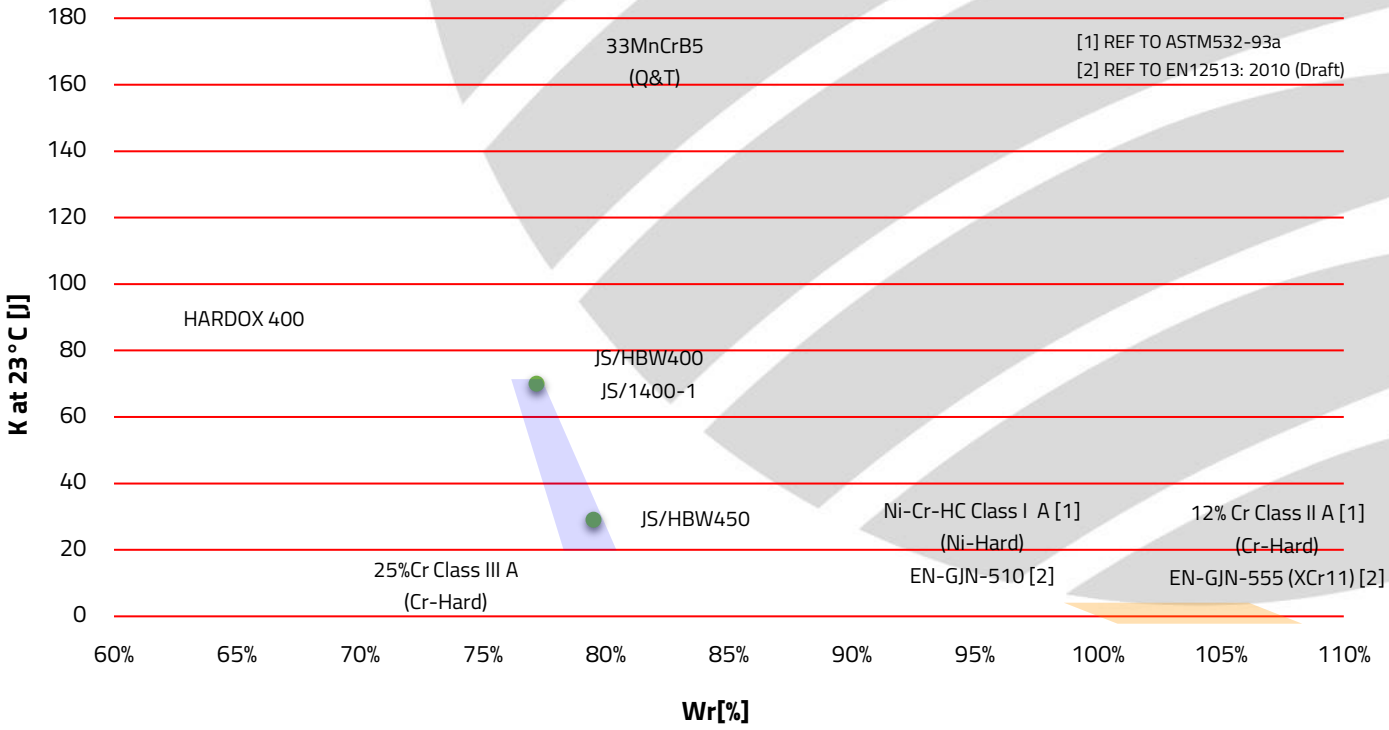
Relative wear resistance Wr [%] in following diagram is as follows:

$$W_r[\%] = \frac{1}{\frac{W_{test\_mat}[mm^3/m]}{W_{ref\_mat}[mm^3/m]}} \cdot 100$$

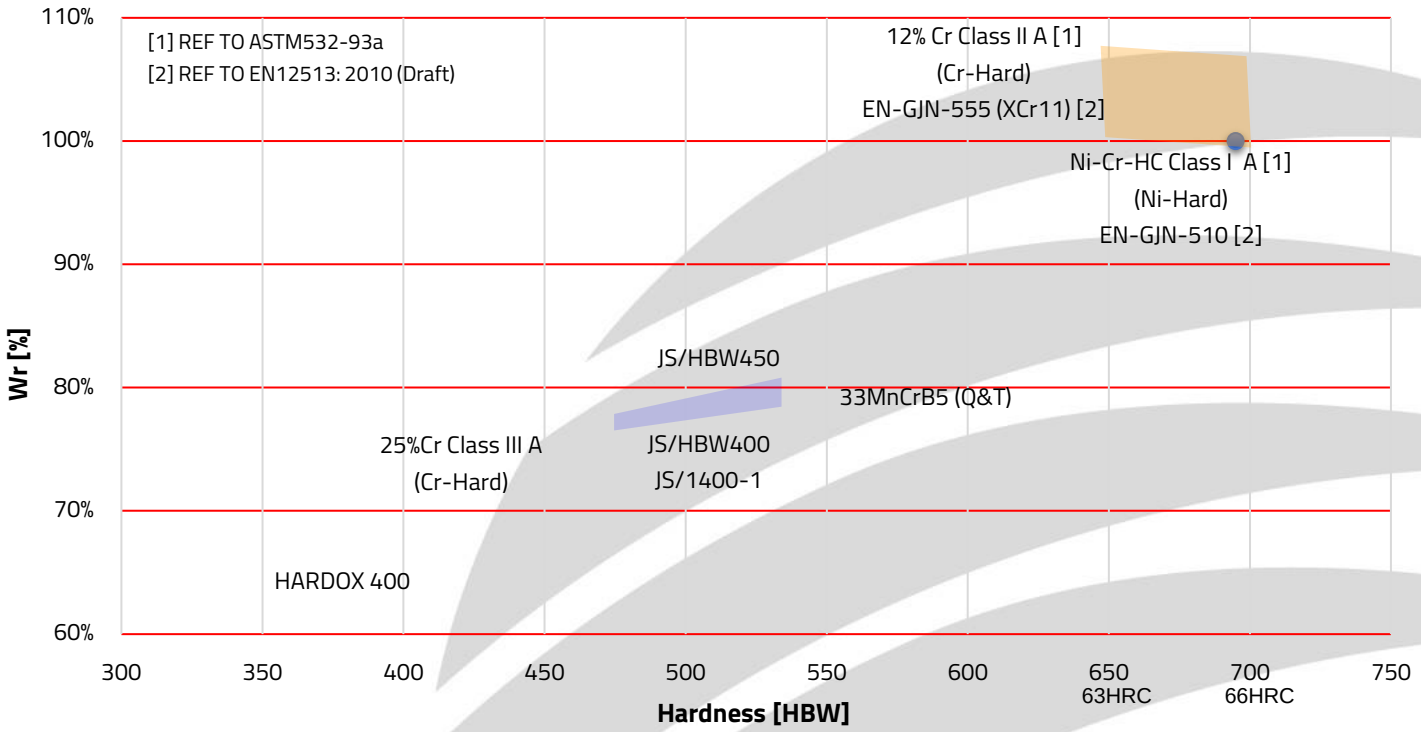
where W represents the wear rate of material loss. Reference material Ni-Hard cast iron has been assumed (Wr=100%).

This test method imposes conditions that cause measurable mass losses and it is intended to rank materials for applications in which moderate to severe abrasion occurs. Test materials should be reasonably resistant to such abrasion. Since this abrasion test does not attempt to duplicate all of the conditions that may be experienced in service (for example, abrasive particle size, shape, hardness, speed, load, and presence of a corrosive environment), there is no assurance that this test method will predict the wear rate of a given material under conditions differing from those in this test method.

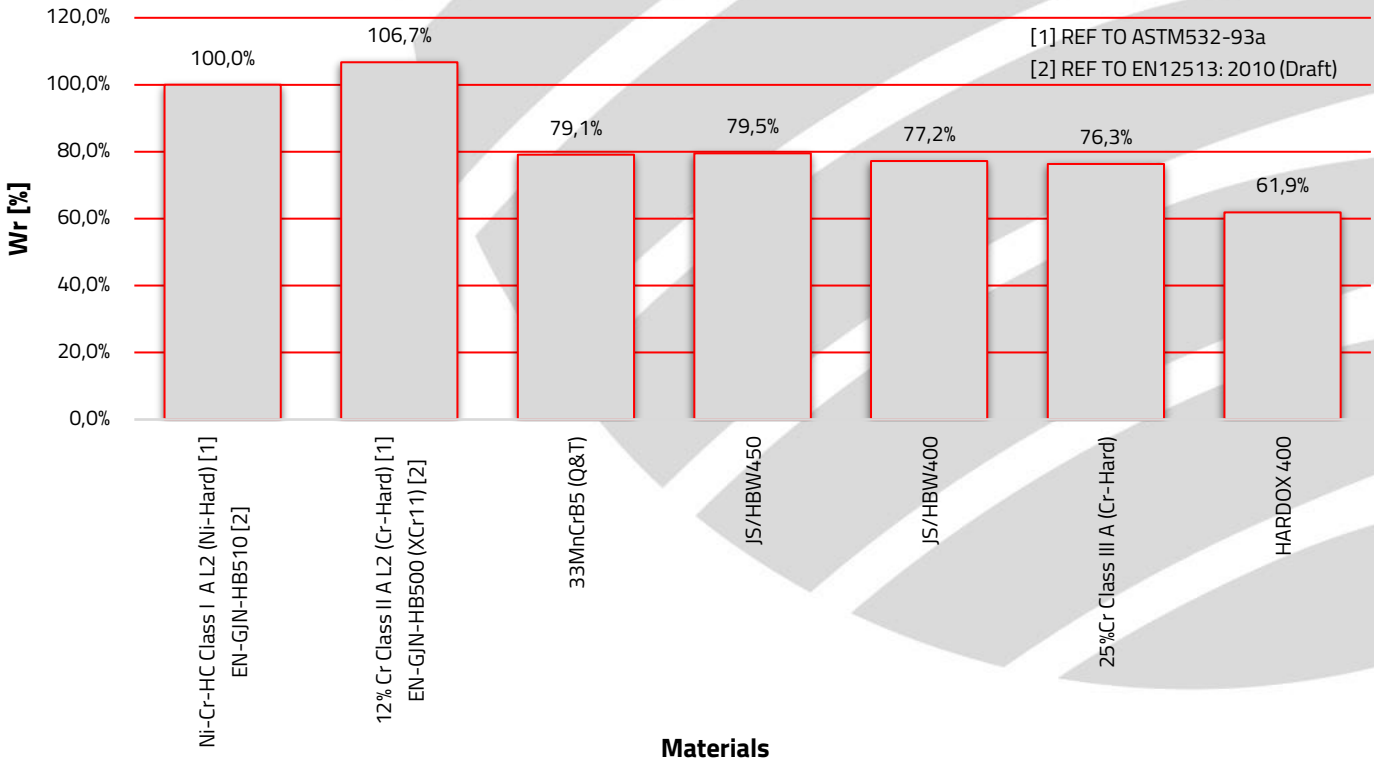
Graphic 1 - Un-notched impact energy vs relative wear resistance



Graphic 2 - Relative abrasion resistance vs hardness



Graphic 3 - Relative Abrasion Resistance



Other properties

ADI - Informative values from international standard ISO17804:2020.

Table 2 – Other properties

Reference	Poisson ratio ν [-]	Density [kg/dm³]	E [GPa]	λ [W/m°K]	α [µm/m°K]
JS/1400-1 **JS/HBW400** **JS/HBW450**	0.27	7.2	170	23÷20	18÷14