

# EX1 ESR

Suit for Die casting, extrusion and **plastic** tools which have high heat resistance and toughness properties, due to its various characteristics, suit for high demand structural components, body integrated die casting molds, and other high demand fields, NADCA Class C grade die casting steel.

material characteristics	material number / grade	SWG EX1 VICTORY ESR					
	short designation	X35CrMoV5-2					
	comparable grade	1.2343+Mo SuperClean ESR, AISI H11+Mo ESR					
	chemical composition - reference analysis [%]	C	Si	Mn	Cr	Mo	V
		0.35	≤ 0.50	≤ 0.50	5.00	2.20	0.55
	production technology	EAF/LF/VD/ESR, (3D) forging, EFS annealing					
	service hardness / strength		HB	HRC	N/mm <sup>2</sup>		
			-	40 - 52	-		
	delivery condition	annealed	≤ 220	-	-		
	maximum dimension	diameter			thickness		
	≤ 800 mm			≤ 550 mm			
US-specification	EN 10228-3			SEP 1921			
	table 3 - type 1 - qual. class 4			group 3 - class E,e			
cleanliness	DIN 50602			ASTM E45 method A			
	K1 ≤ 10			A ≤ 0,5; B, C, D ≤ 1			

technological properties		0	1	2	3	4	5	comment
	toughness		■	■	■	■		
	hot strength at working temp.		■	■	■	■	■	
	wear resistance		■	■	■	■	■	
	corrosion resistance	■						
	machinability		■	■				annealed
	polishability		■	■	■	■		ISO/SPI: N0/A-1, 48-52 HRC
	weldability		■					CET = 0.85 % acc. DIN EN 1011-2
	texturability		■	■	■	■	■	hardened
	nitridability		■	■	■	■	■	nitriding hardness 900 - 1250 HV1
chrome-platability		■	■	■	■	■	high cleanliness	

rating properties: 0 = not suitable; 1 = low; 2 = middle; 3 = good; 4 = very good; 5 = perfectly suitable

physical properties	thermal conductivity [W · m <sup>-1</sup> · K <sup>-1</sup> ]	20 °C	200 °C	300 °C	500 °C
		23.6	28.2	28.4	27.4
	coefficient of thermal expansion between 20 °C and ... [10 <sup>-6</sup> · K <sup>-1</sup> ]	100 °C	200 °C	300 °C	500 °C
		11.9	12.4	12.6	13.0
elastic modulus [kN/mm <sup>2</sup> ]	20 °C	200 °C	300 °C	500 °C	
		212	199	192	175

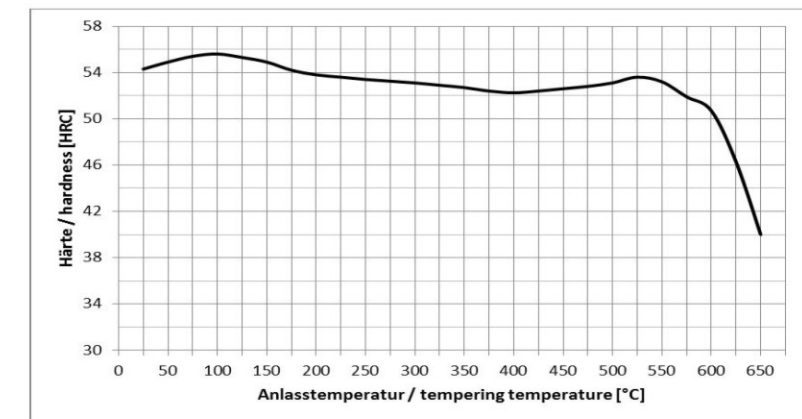
application	technology	mold making, die-casting
	tools	die-casting molds and inserts with high thermal load, high life time
	process temperature	< 600 °C
	tool size	medium-and large-sized dies
	final products	die-casting parts
	features	for highest requirements on hot strength and toughness, SuperClean technology

SWG processing instructions	welding, vacuum hardening
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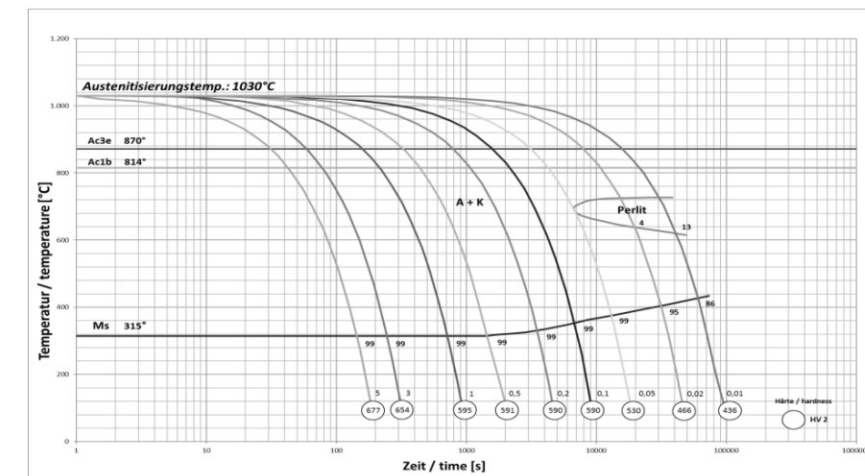
heat treatment		T min [°C]	T max [°C]	medium / comment
	annealing	820	840	furnace until 650 °C, air
	hardening	1010	1030	vacuum, oil
	tempering	530	650	air, protective gas
	stress relieving	500	550	min. 30 °C below tempering temp.
	pre-heating before welding	300	320	
	nitriding	480	550	min. 30 °C below tempering temp.
	PVD-treating	480	550	

diagrams/ structure	CCT-diagram	yes
	tempering diagram	yes
	advice on heat treatment	vacuum hardening or warmbath after pre-machining
	microstructure	martensitic

Tempering diagram:



CCT-diagram



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### 德标钢种 Din Grades

应用 Application	交付状态 Delivery Condition	钢种 Grade	化学成分 % Typical SWG analysis in w%						硬度(表面) Service hardness (surface)
			C	Cr	Mo	Ni	V	其它 Others	
塑胶钢 Plastic Mold Steels	预硬 Q+T	2311	0.40	2.00	0.20	-	-	-	28-34 HRC
		2312	0.40	1.90	0.20	-	-	S-0.05	28-34 HRC
		2738 / 2738H / 2738HH	0.36	1.80	0.20	1.10	-	-	30-38 HRC
		2711mod	0.55	1.10	0.80	2.00	0.10	-	36-42 HRC
		2714	0.55	1.10	0.50	1.70	0.10	-	38-44 HRC
	退火annealed	2767	0.45	1.25	0.20	3.90	-	-	49-53 HRC
不锈钢 Corrosion Resistant Steels	预硬 Q+T	2085	0.33	16.00	-	<1.00	-	S-0.08	28-34 HRC
		2316	0.35	15.50	1.00	0.50	-	-	28-34 HRC
		2316 VICTORY ESR	0.35	15.50	1.00	0.50	-	-	28-34 HRC
		2316mod VICTORY ESR	0.26	15.00	1.00	0.70	-	-	28-34 HRC
	预硬 Q+T 退火 annealed	2083	0.40	13.00	-	-	-	-	32-52 HRC
		2083 VICTORY ESR	0.40	13.00	-	-	-	-	32-52 HRC
		2083mod VICTORY ESR	0.38	13.00	-	-	0.25	添加 alloyed	29-52 HRC
		2343 / EX3	0.36	5.00	1.20	-	0.40	-	36-52 HRC
热作钢 Hot Work Steels	超精细化 退火 EFS- annealed	2343 VICTORY ESR	0.36	5.00	1.20	-	0.40	-	36-52 HRC
		2344 / EX4	0.40	5.20	1.30	-	1.00	-	36-52 HRC
		2344 VICTORY ESR	0.40	5.20	1.30	-	1.00	-	36-52 HRC
		2367 VICTORY ESR	0.36	5.10	2.80	-	0.55	-	35-52 HRC
		2357	0.50	3.30	1.50	-	0.25	-	52-56 HRC
冷作钢 Cold Work Steels	退火 annealed	2379	1.55	12.00	0.90	-	0.90	-	58-62 HRC

### 葛利兹钢种 SWG Grades

交付状态 Delivery Condition	钢种 Grade	化学成分 % Typical SWG analysis in w%						硬度(表面) Service hardness (surface)
		C	Cr	Mo	Ni	V	其它 Others	
预硬 Q+T	738HH	0.27	1.35	添加 alloyed	1.00	-	添加 alloyed	32-38 HRC
	XPM	0.27	1.35	0.50	1.00	-	添加 alloyed	38-42 HRC
	XPM VICTORY ESR	0.30	1.35	0.70	1.00	-	添加 alloyed	38-42 HRC
	CPM40 VICTORY ESR	0.15	4.00	1.10	3.00	-	添加 alloyed	38-42 HRC
	GEST80 VICTORY ESR	0.14	0.30	0.30	2.80	-	Cu, Al	38-42 HRC
	退火annealed	GPM58 VICTORY ESR	0.50	5.00	2.20	添加 alloyed	0.70	-
预硬 Q+T	CPM50 VICTORY ESR	0.28	14.00	-	0.60	-	N	38-42 HRC
退火 annealed	CRMHP VICTORY ESR	0.25	14.00	-	0.60	-	N	50-52 HRC
	OPTI N+ PESR	0.15	14.00	-	0.60	-	N	50-57 HRC
	HNS28 PESR	0.25	14.00	-	0.60	-	N	57-59 HRC
	HNS40HC PESR	0.40	15.00	2.00	<0.50	<1.50	N	58-60 HRC
	Cronidur®30 PESR	0.30	15.00	1.00	0.50	-	N	58-60 HRC
退火 annealed	EX1 VICTORY ESR	0.35	5.00	2.20	-	0.55	-	40-52 HRC
	2343PLUS VICTORY ESR	0.38	5.00	1.80	-	0.55	-	40-52 HRC
	EX55 VICTORY ESR	定制产品 Customized Steel						40-52 HRC
	EX6 VICTORY ESR	0.43	6.40	1.30	-	0.90	-	52-56 HRC

# 葛利兹钢材特性-应用参考表

## Gröditz Steel Characteristic- Application Reference

特性比例(Characteristic ratio): 0=不适合(NA) / 1=低度(LOW) / 2=中度(Medium) / 3=好(Good) / 4=很好(Very good) / 5=非常好(Excellent)

Grade 钢种	Chemical Composition (%)化学成分-範圍值							Machin-Ability 机加性能					Polish-Ability 抛光性能					Grain-Ability 蚀纹性能					Wear-Ability 耐磨性能					Weld-Ability 焊接性能									
	C	Si	Mn	Cr	Mo	Ni	Others	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5
	2311	0.40	0.30	1.50	2.00	0.20				■	■	■				■						■	■					■	■					■	■	■	
2312	0.40	0.30	1.50	1.90	0.20		S:0.05		■	■	■	■	■	■					■							■	■					■	■	■			
2738	0.36	0.25	1.50	1.80	0.20	1.10			■	■	■	■			■	■				■	■					■	■	■				■	■	■			
738HH	0.27	0.30	1.35	1.35	add	1.00	add		■	■	■	■			■	■	■			■	■	■				■	■	■	■			■	■	■	■		
XPM	0.27	0.30	1.55	1.35	0.50	1.0	add		■	■	■	■			■	■	■			■	■	■	■			■	■	■				■	■	■	■		
XPM ESR	0.30	0.30	1.55	1.35	0.70	1.00	add		■	■	■	■			■	■	■	■		■	■	■	■			■	■	■	■			■	■	■			
2711	0.55	0.25	0.70	0.70	0.30	1.70	V:0.1		■	■					■	■				■	■					■	■	■	■			■	■				
2714	0.55	0.25	0.70	1.10	0.50	1.70	V:0.1		■	■					■	■				■	■					■	■	■	■			■	■				
GEST 80 ESR	0.14		1.40	0.30	0.30	2.80	Cu:0.9 Al:0.3		■	■	■				■	■	■	■		■	■	■	■			■	■	■	■			■	■	■			
CPM 40	0.15	0.30	0.50	4.00	1.10	3.00	add		■	■					■	■	■	■		■	■	■	■			■	■	■	■			■	■				
2343(EX3)	0.36	1.00	0.35	5.00	1.20		V:0.4		■	■	■	■			■	■	■			■	■					■	■	■	■			■					
2343(EX3) ESR	0.36	1.00	0.35	5.00	1.20		V:0.4		■	■	■	■			■	■	■	■		■	■	■	■			■	■	■	■	■		■	■	■	■		
2344(EX4)	0.4	1.00	0.40	5.20	1.30		V:1.0		■	■	■	■			■	■	■			■	■	■				■	■	■	■	■		■					
2344(EX4) ESR	0.4	1.00	0.40	5.20	1.30		V:1.0		■	■	■	■			■	■	■	■		■	■	■	■			■	■	■	■	■		■					
2767	0.45	0.25	0.35	1.25	0.20	3.90			■	■	■	■			■	■	■			■	■	■	■			■	■	■	■	■		■	■				
GPM 58 ESR	0.5	≤0.5	0.50	5.00	2.20		V:0.7 Ni+		■	■					■	■	■	■		■	■	■	■			■	■	■	■	■		■					

交货状态 Delivery Status : (字段颜色 field color)---■ : 预硬模具钢料(Pre-hardened steel) / ■ : 退火模具钢料(Anneal steel)

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# 葛利兹不锈钢钢材系列特性-应用参考表

## Gröditz Steel Characteristic- Application Reference

特性比例(Characteristic ratio) : 0=不适合(NA) / 1=低度(Low) / 2=中度(Medium) / 3=好(Good) / 4=很好(Very good) / 5=非常好(Excellent)

Grade 钢种	Chemical Composition (%)化学成分-范围值							Machin-Ability 机加性能					Polish-Ability 抛光性能					Grain-Ability 蚀纹性能					Wear-Ability 耐磨性能					Weld-Ability 焊接性能											
	C	Si	Mn	Cr	Mo	Ni	Others																																
								0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5		
2316	0.35	0.35	0.70	15.50	1.00	0.50			■	■						■	■					■							■	■					■				
2085	0.33	≤1.00	≤1.00	16.00		≤1.00	S:0.08		■	■	■	■	■	■	■							■							■	■					■				
CPM50 ESR	0.28	0.30	0.40	14.00		0.60	+N		■	■						■	■	■	■			■	■	■	■				■	■	■				■				
2083	0.40	0.40	0.70	13.00					■	■	■					■	■	■				■							■	■	■	■			■				
2083 ESR	0.40	0.40	0.70	13.00					■	■	■	■	■	■		■	■	■	■	■		■	■	■	■	■			■	■	■	■			■				
2083 mod ESR	0.38	1.00	0.50	13.00			V:0.25		■	■	■					■	■	■	■	■		■	■	■	■				■	■	■	■			■				
CRMHP	0.25	0.30	0.40	14.00		0.60	+N		■	■						■	■	■	■	■		■	■	■	■				■	■	■	■			■				
OPTI N+	0.15	0.30	0.40	14.00		0.60	+N		■							■	■	■	■	■		■	■	■	■	■	■		■	■	■	■	■		■				

Grade 钢种	Chemical Composition (%)化学成分-范围值							Corrosion resistance 耐蚀能力					Toughness 韧性					Chrome platability 镀铬性能					Nitridability 氮化性能																
	C	Si	Mn	Cr	Mo	Ni	Others																																
								0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5	0	1	2	3	4	5								
2316	0.35	0.35	0.70	15.50	1.00	0.50			■	■	■	■	■			■	■	■				■							■										
2085	0.33	≤1.00	≤1.00	16.00		≤1.00	S:0.08		■	■	■					■						■							■										
CPM50 ESR	0.28	0.30	0.40	14.00		0.60	+N		■	■	■	■	■			■	■	■	■			■	■	■					■										
2083	0.40	0.40	0.70	13.00					■	■	■					■						■							■										
2083 ESR	0.40	0.40	0.70	13.00					■	■	■	■	■			■	■					■	■	■	■				■										
2083 mod ESR	0.38	1.00	0.50	13.00			V:0.25		■	■	■	■	■			■	■					■	■	■	■				■	■	■	■			■				
CRMHP ESR	0.25	0.30	0.40	14.00		0.60	+N		■	■	■	■	■	■		■	■	■	■	■		■	■	■	■	■	■		■										
OPTI N+	0.15	0.30	0.40	14.00		0.60	+N		■	■	■	■	■	■		■	■					■	■	■	■	■	■		■										

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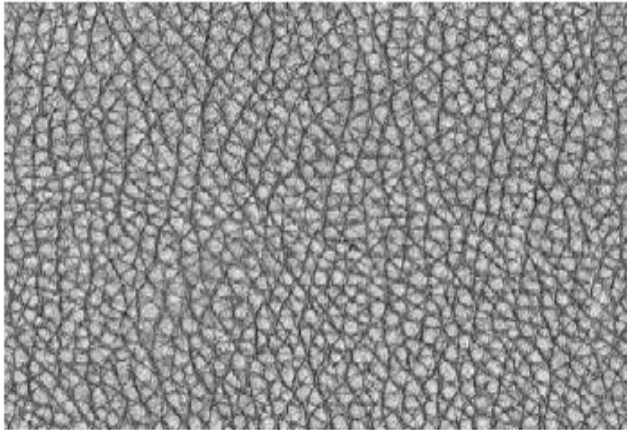
Plastic 塑料		Plastic type 胶料种类	Recommendation 推荐	
			Steel grade 钢种	Hardness 硬度
Normal plastic 常用型胶料	Without corrosion 不带腐蚀性	PP, ABS, PE ,PS , .....	2738/2738H 738HH XPM/XPMESR 2343/2344(EX3/EX4) 2343ESR/2344ESR(EX3ESR/EX4ESR) 2083/2083ESR	HRC29-38 HRC32-38 HRC35-42 HRC44-52 HRC48-52 HRC42-52
	With corrosion 带腐蚀性	PVC, POM , PA, SAN,PMMA .....	2316 2083/2083ESR CRMHP OPTI N+	HRC28-34 HRC42-52 HRC50-52 HRC54-57
Special plastic 特殊添加型胶料	+ < Plastic +GF% or Talc 加玻签或滑石粉.... 增强塑料	+ < 30% GF(Glass Fiber) or Talc 加 30%以下的增强型胶料	2738/2738H 738HH XPM/XPMESR GEST80 CPM40	HRC29-38 HRC32-38 HRC35-42 HRC38-42 HRC38-42
		+ > 30% GF(Glass Fiber) or Talc 加 30%以上的增强型胶料	2343/2344(EX3/EX4) 2343ESR/2344ESR(EX3ESR/EX4ESR) 2083/2083ESR CRMHP OPTI N+ GPM58	HRC48-52 HRC48-52 HRC42-52 HRC50-52 HRC54-57 HRC54-58
	Plastic + fire retardant 阻燃增强胶料	Added Cl-,Br-,P3- based fire retardant product 添加 Cl-,Br,P3-基阻燃剂胶料	2316 2083/2083ESR CRMHP OPTI N+	HRC28-34 HRC42-52 HRC50-52 HRC54-57

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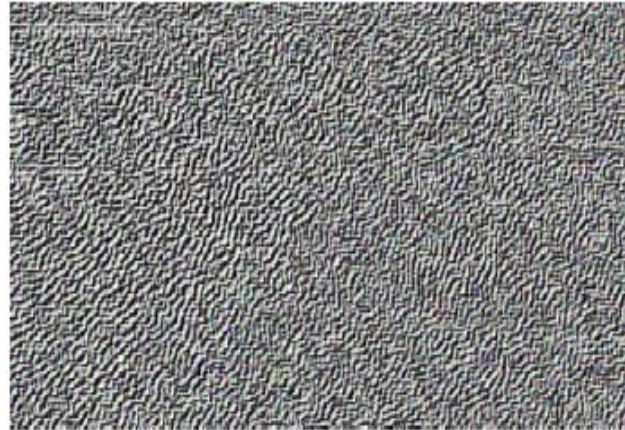


Gröditz Steel Grade Application-Texture level

**Normal Texturing**  
**SWG 738HH**



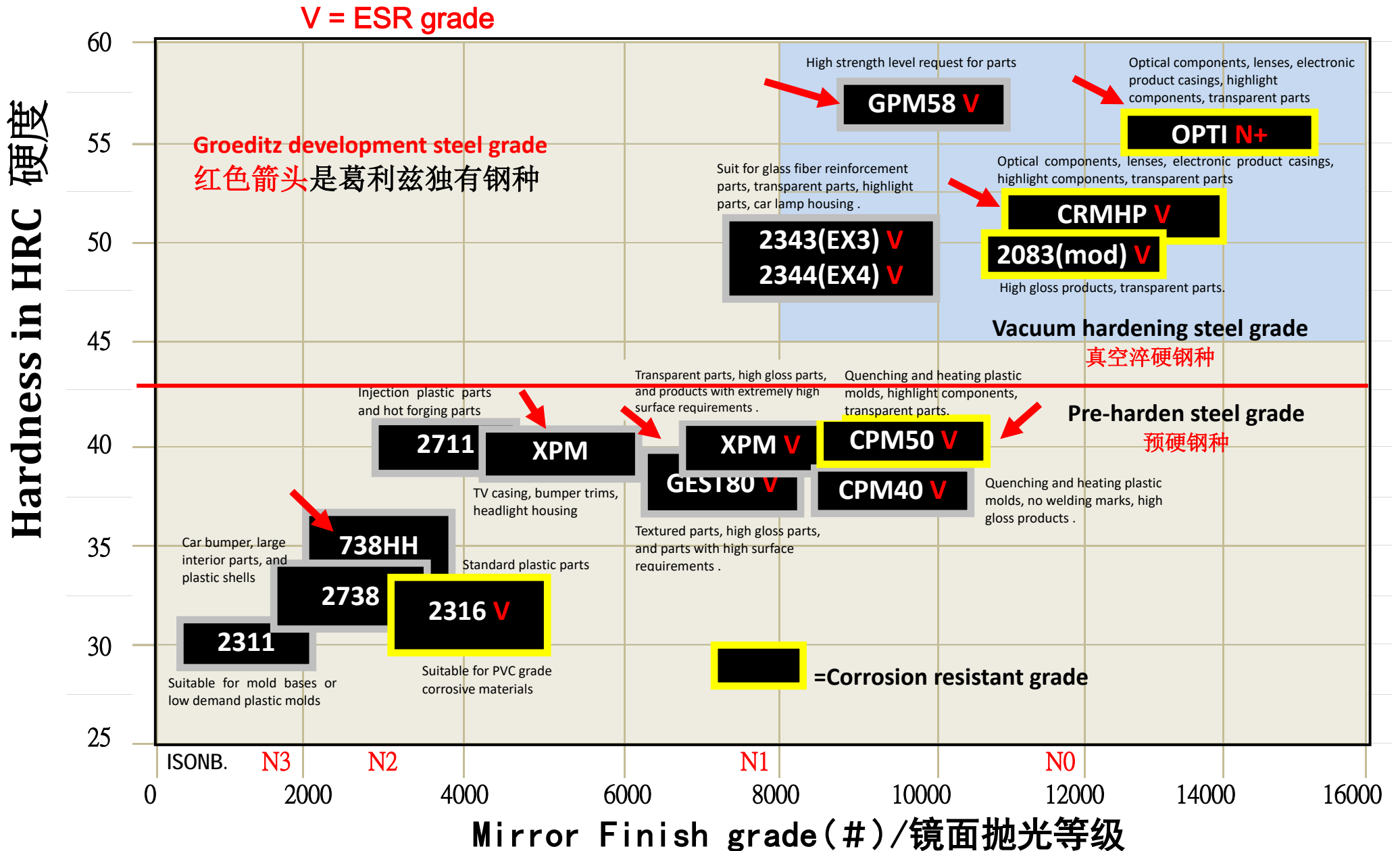
**High Texturing**  
**SWG XPM**



**Fine and Geometric Texturing**  
**SWG 2083ESR, CRMHP ESR, GEST80 ESR**







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## 葛利兹钢材-压铸模选材建议 Gröditz Steel - Recommendations for Die Casting

Grade 钢种	Characteristics and application 性能特点及应用
2343 VICTORY ESR	欧洲常用钢种，低偏析率，高韧性，高热传导系数，适用于大型模具。 Standard grade in Europe, low segregation, high toughness, good thermal conductivity, save solution for large moulds.
2344 VICTORY ESR	北美及亚洲常用钢种，适用于耐高温负荷要求、高耐磨性要求、易产生热龟裂模具。 Standard grade in NA and ASIA, for thermal high loaded tools, for tools with higher wear resistance, for heat checking sensitive moulds.
EX8 VICTORY ESR 2343 Plus	2343 的改良钢种，具有比 2343 更好的韧性、抗龟裂性及耐磨性，纯净度极高，适用于中大型模具。 Improved 2343 but higher in toughness, crack resistance and hot-strength, super clean metallurgy, applicable to medium and large moulds.
EX1 VICTORY ESR	高性能热作模具钢，具有优异的抵抗热龟裂、整体开裂、热磨损和塑性变形的性能，适用于长寿命模具。 High performance hot work die steel with excellent resistance to thermal cracking, overall cracking, thermal wear and plastic deformation, suitable for long life molds.
2367 VICTORY ESR	适用于耐超高温负荷要求、极高耐磨性要求、极易产生热龟裂的中小型模具。 For very thermal high loaded inserts, for moulds with highest wear senility, for extremely heat checking sensitive moulds.
GPM58 VICTORY ESR	适用于耐超高温负荷要求、极高耐磨性要求的小型模具及镶件，锌合金模具。 For small moulds and inserts with requirements of high temperature load resistance and high wear resistance, zinc alloy molds.
<b>&gt;6,000T 一体压铸模具</b> (后地板, 前舱, 电池托盘等) Over 6,000T Giga casting mold (Rear body, front cabin, battery tray, etc.)	2343 VICTORY ESR EX8 VICTORY ESR EX1 VICTORY ESR
<b>2,500-4,500T 传统结构件</b> (减震塔, 纵梁, 仪表盘支架, 多合一电驱壳体等) 2,500-4,500T traditional structural components mold(shock tower, longitudinal beam, instrument panel bracket, electric drive housing, etc.)	2343 VICTORY ESR EX8 VICTORY ESR EX1 VICTORY ESR
<b>&lt;2,500T 中型模具</b> (离变壳, 电机壳等) Medium mold within 2500T(Gear box, motor housing, etc.)	2344 VICTORY ESR EX8 VICTORY ESR EX1 VICTORY ESR
<b>小型模具及镶块</b> Small molds and inserts	2344 VICTORY ESR EX1 VICTORY ESR 2367 VICTORY ESR GPM58 VICTORY ESR



North American Die Casting Association

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January 4th, 2021  
Tom Bell  
Gröditz Steel North America  
A subsidiary of Schmiedewerke Gröditz GmbH  
21660 W. Field Parkway  
Deer Park, IL 60010

Dear Tom,

This letter is in regards to the two Specimens SWG EX1+EX55 VICTORY ESR and SWG 2344 VICTORY ESR, that were submitted for approval to the NADCA 229-2018 "Special Quality Die Steel & Heat Treatment Acceptance Criteria for Die Casting Dies".

Schmiedewerke Gröditz GmbH, Germany submitted 2 specimens to be tested to the NADCA 229-2018 Standard.

- 1) Premium Class C - SWG EX1 VICTORY ESR  
Premium Class C - SWG EX55 VICTORY ESR
- 2) Premium Class B - SWG 2344 VICTORY ESR

The testing results were completed by Element labs, 194 Internationale Blvd, Glendale Heights, Illinois 60139 and Case Western Reserve University.

A summary follows:

SWG EX1 VICTORY ESR Premium Class C  
SWG EX55 VICTORY ESR Premium Class C

Microcleanliness - Pass  
ASTM Grain size - 9.5  
Banding - Pass  
Charpy Values - 24, 22, 24 - Pass  
Fatigue Test (CWRU) - Pass  
**Overall Evaluation - Pass**

SWG 2344 VICTORY ESR Premium Class B

Microcleanliness - Pass  
ASTM Grain size - 7.5  
Banding - Pass  
Charpy Values - 17, 18, 18 - Pass  
Fatigue Test (CWRU) - Pass  
**Overall Evaluation - Pass**

Regards,

Paul Brancaleon,  
Director of Research, Education and Technology  
North American Die Casting Association

**葛利兹提交了 EX1 ESR 试样按照  
NADCA229-2018 标准进行测试  
SWG EX1 VICTORY ESR 优质 C 类  
纯净度-通过  
ASTM 标准晶度-9.5  
带状偏析-通过  
夏比冲击值-24,22,24-通过  
疲劳测试(CWRU)-通过  
整体评估-通过**



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October 3, 2023

Tom Bell  
GMH Group  
Gröditz Forgings & ETE  
21660 W. Field Parkway  
Deer Park, IL 60010

Tom,

This letter is in regards to the one specimen of Schmiedewerke Gröditz - SWG 2343 VICTORY ESR (Grade D) H13 that was submitted for approval to the NADCA #207-2022 "Special Quality Die Steel & Heat Treatment Acceptance Criteria for Die Casting Dies".

Schmiedewerke Gröditz GmbH submitted 1 specimen to be tested to the NADCA #207-2022 Standard.

- 1) Type H11 - 2343 (Grade D) Din 1.2343 ESR Material

The testing results were completed at Element labs, 194 International Blvd, Glendale Heights, Illinois 60139 and Case Western Reserve University. These results are attached to this document.

A summary follows.

Schmiedewerke Gröditz - 2343 VICTORY ESR, Din 1.2343

ASTM E45 - Microcleanliness - Acceptable  
ASTM E112 Micro examination Grain size - 9.5 Acceptable  
Charpy Values - at 76 °F, 15, 15, 13 - Average of 14.3 - Pass  
ASTM E3-11 (17) - Banding - Acceptable, Structure - Acceptable  
ASTM E18-22 Hardness Test - Pass  
Fatigue Test (CWRU) - Pass  
Case Western Reserve University will provide a graph of results upon request.

**Overall Evaluation - Pass**

If you have additional questions, Please let me know.

Regards,

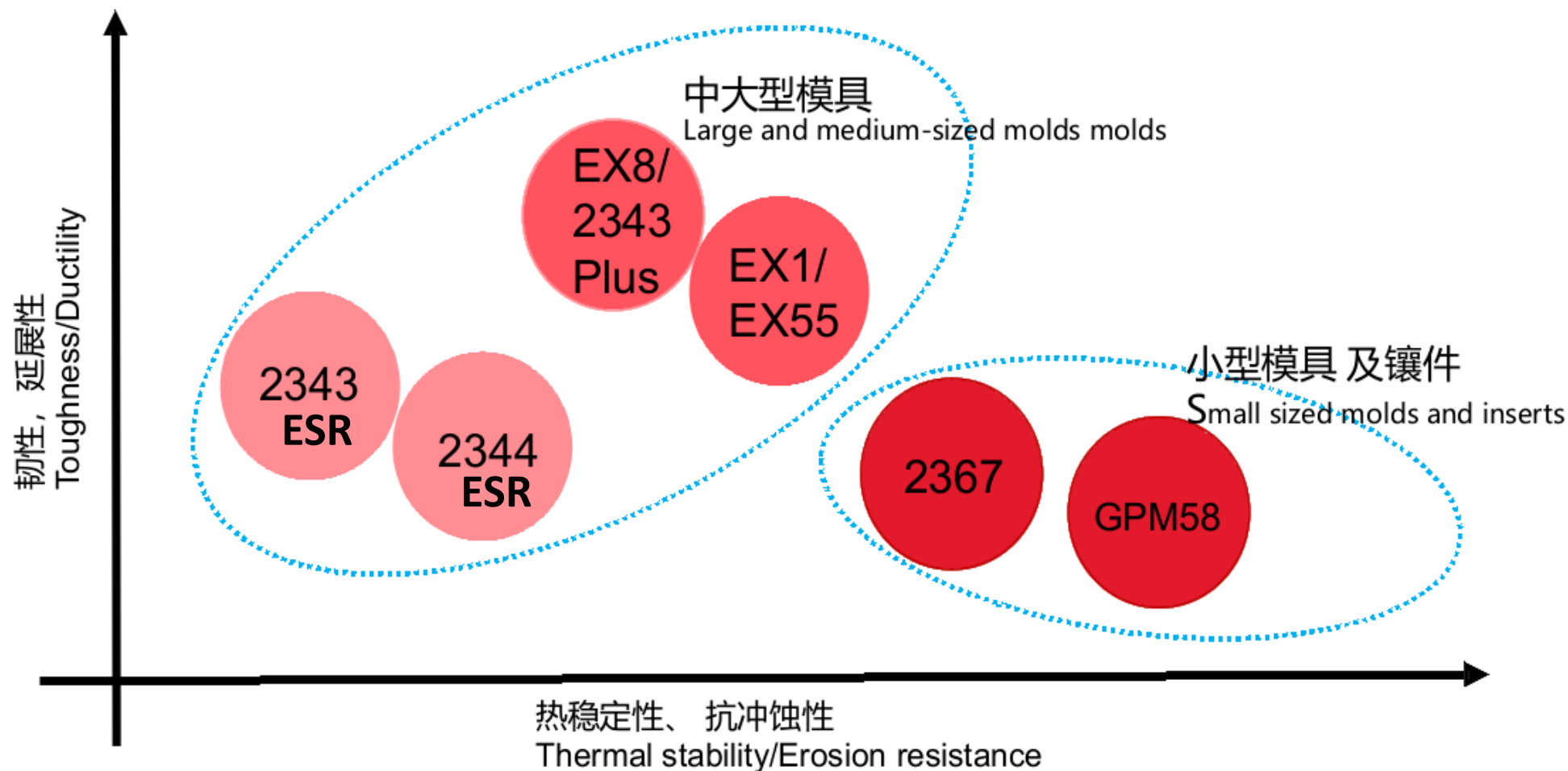
Paul Brancaleon,  
Executive Director of Research, Education and Marketing  
North American Die Casting Association

**葛利兹提交了 2344 ESR 试样按照  
NADCA229-2018 标准进行测试  
SWG 2344 VICTORY ESR 优质 B 类  
纯净度-通过  
ASTM 标准晶度-7.5  
带状偏析-通过  
夏比冲击值-17,18,18-通过  
疲劳测试(CWRU)-通过  
整体评估-通过**



# 压铸应用

## Schmiedewerke Gröditz — Die Casting Application







Schmiedewerke Gröditz  
**GMH GRUPPE**



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