



11-13 September / Eylül 2014
TÜYAP Fair, Convention & Congress Center, İstanbul

7th International Ankiros Foundry Congress
7. Uluslararası Ankiros Döküm Kongresi



**«Latest Developments On Design And Formulations Of Minirisers
For The Feeding Of Ductile Iron And Steel Castings Improving Risers
Removal And Yield With The Consequent Decrease On Cost»**

**«Duktil Dökme Demir ve Çelik Dökümünde Mini Besleyici Kullanımı,
Son Gelişmeler ve Avantajlar»**

**Jaime Prat Urreiztieta
(ASK Chemicals)**

**3.Oturum: Döküm Teknolojileri Demir - Çelik
3rd Session: Casting Technologies Iron - Steel**

Oturum Başkanı/Session Chairman: Seyfi Değirmenci (Componenta Döküm. Tic. San. A.Ş.)



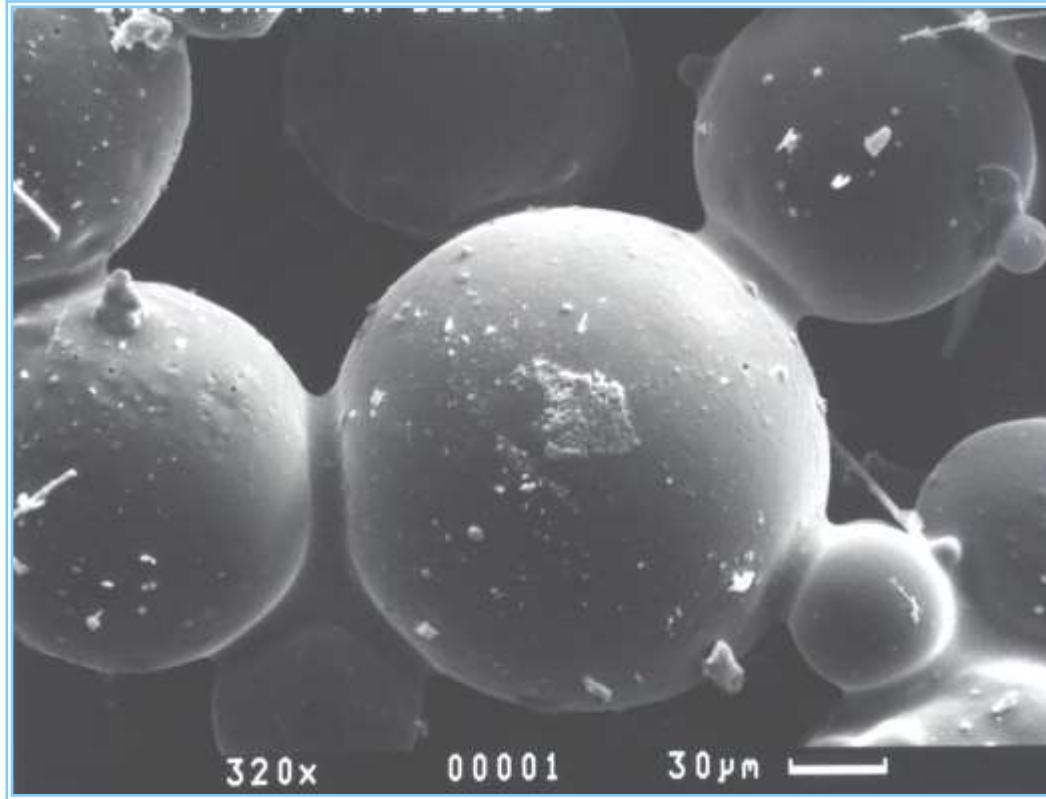


***Latest Developments On Design And Formulations Of
Minirisers For The Feeding Of Ductile Iron And Steel
Castings Improving Risers Removal And Yield
With The Consequent Decrease On Cost***

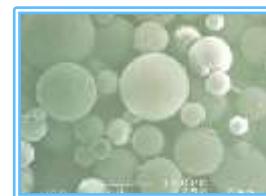
**Jaime Prat Urreiztieta
ASK Chemicals**



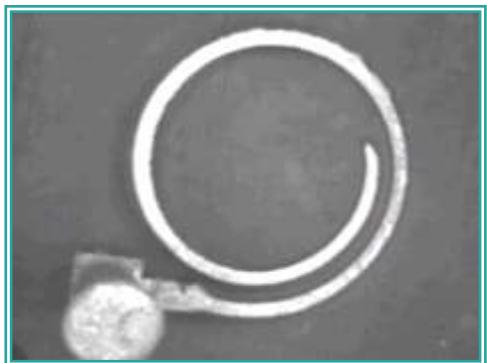
Ask Chemicals Microspheres Feeding Technology



Improved flow / Mix of Sand + EXACTHERM™



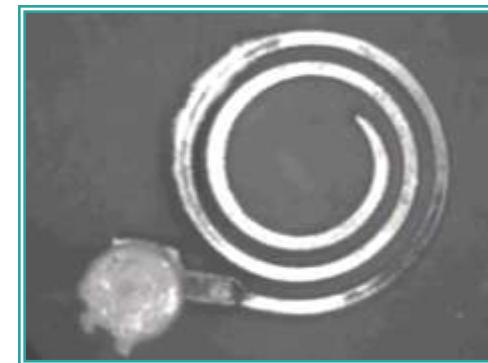
ASKCHEMICALS
We advance your casting



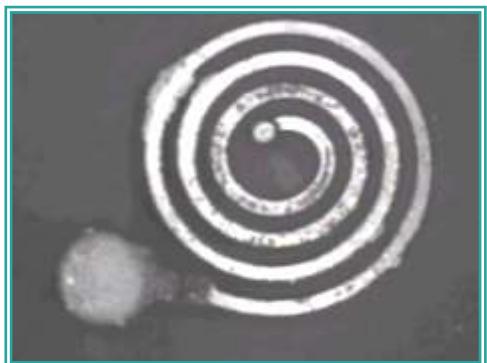
100% Sand Mold



80/20% S/E



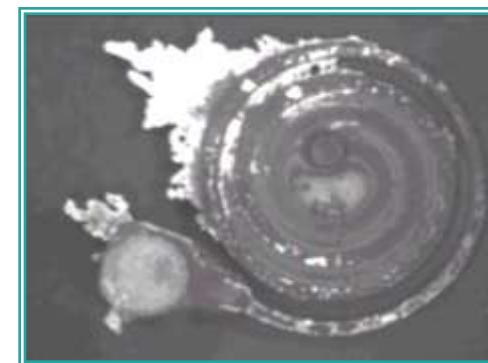
60/40% S/E



40/60% S/E



20/80% S/E



100% EXACTHERM™ Mold

Gray Iron Poured @ 2.550°F



Extension Factor for Ductile Iron

Sleeves

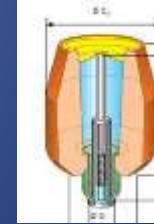
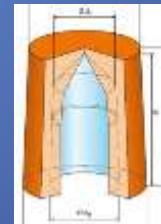


Insulating 1.3

Insulating – Exothermic 1.6

Minirisers

Sand 2.3



Insulating – Exothermic 2.3

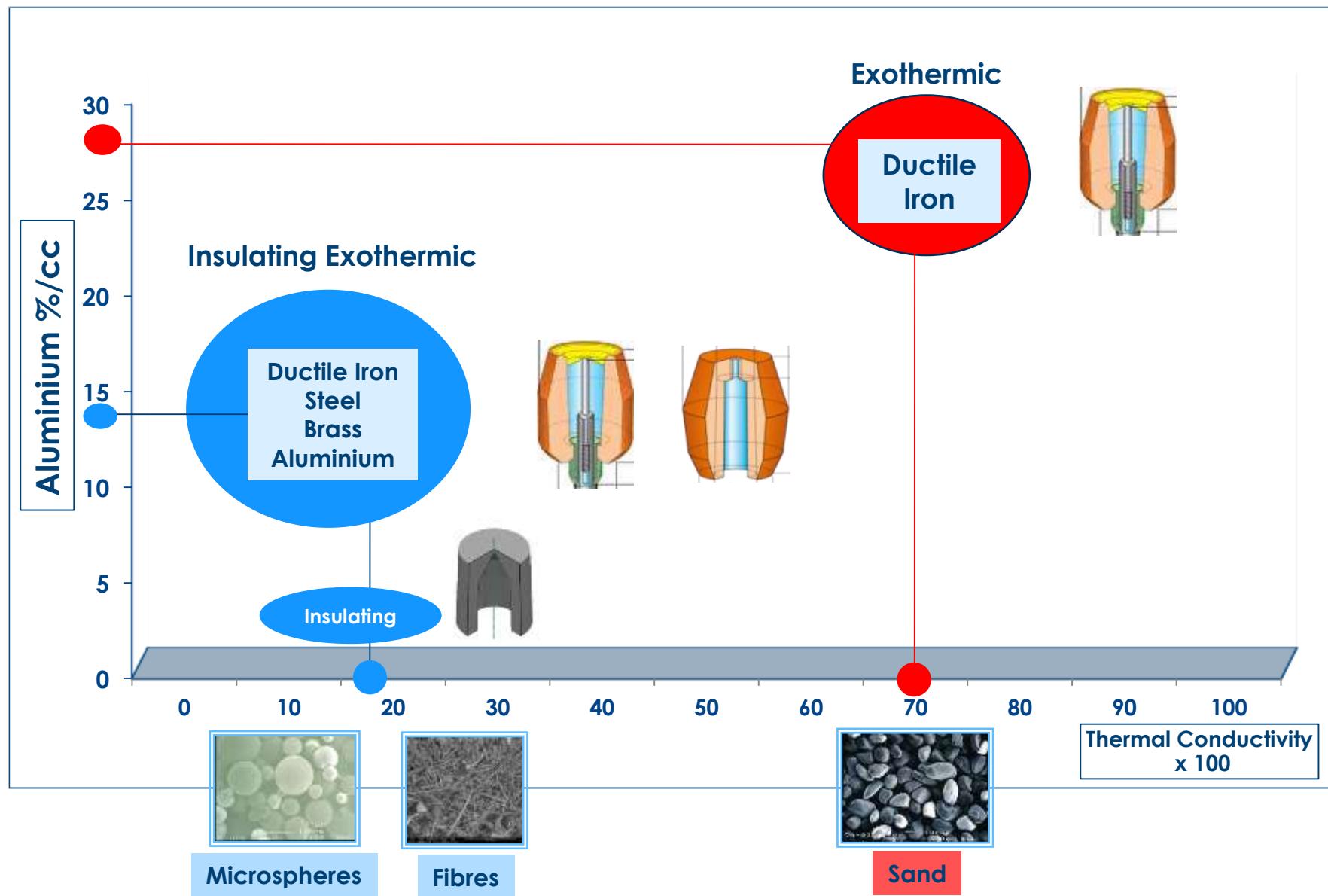


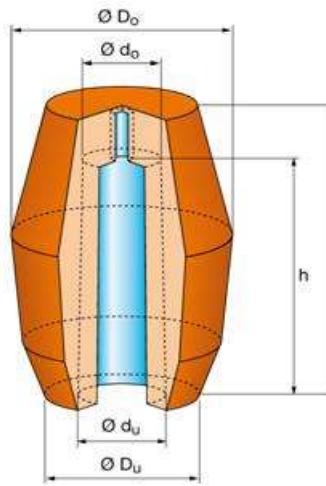
ADVANTAGES OF THE NEW SLEEVES TECHNOLOGIES

Improves yield

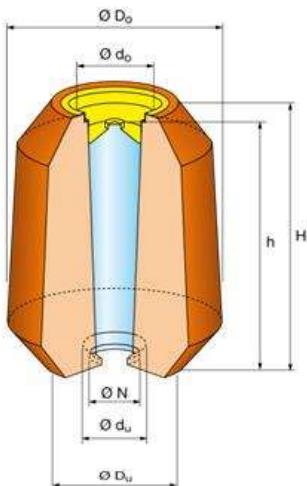
Decreases the Fletting

Minimizes the effects caused by the sleeves

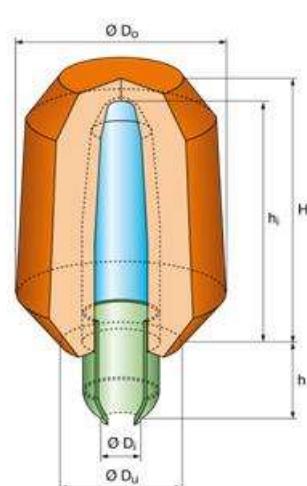




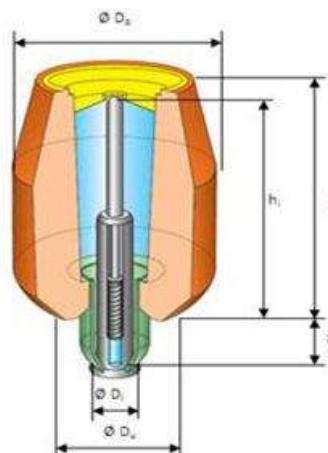
KMV



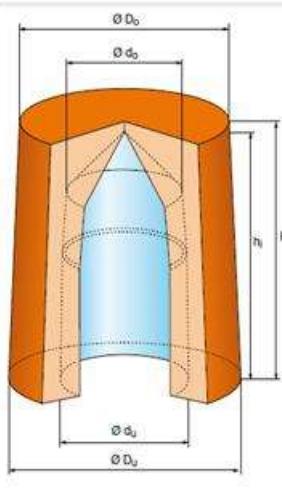
KMV - QT



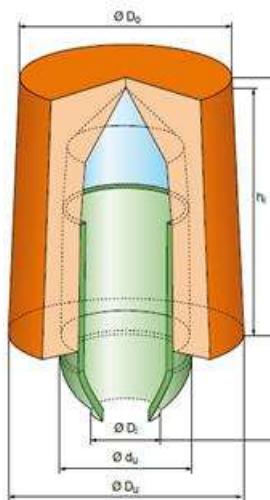
KMV - QM



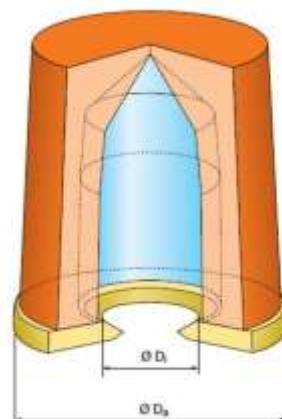
KMV - CC



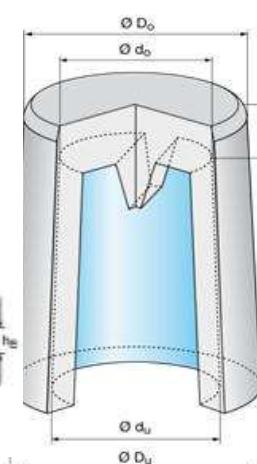
KIM



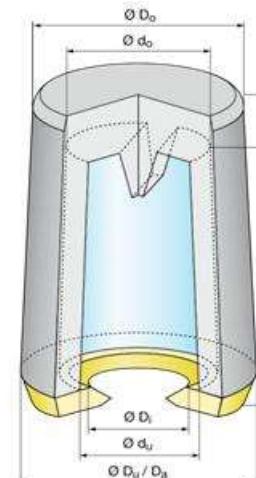
KIM - QM



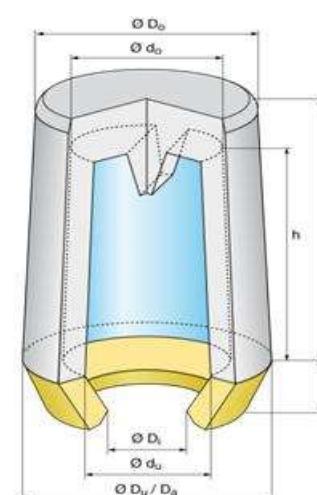
KIM - GP



KI



KI - GP



KI - E



Defects caused by the Sleeves Fluorine content:

- 1. Fish Eye**
- 2. Graphite Degradation**

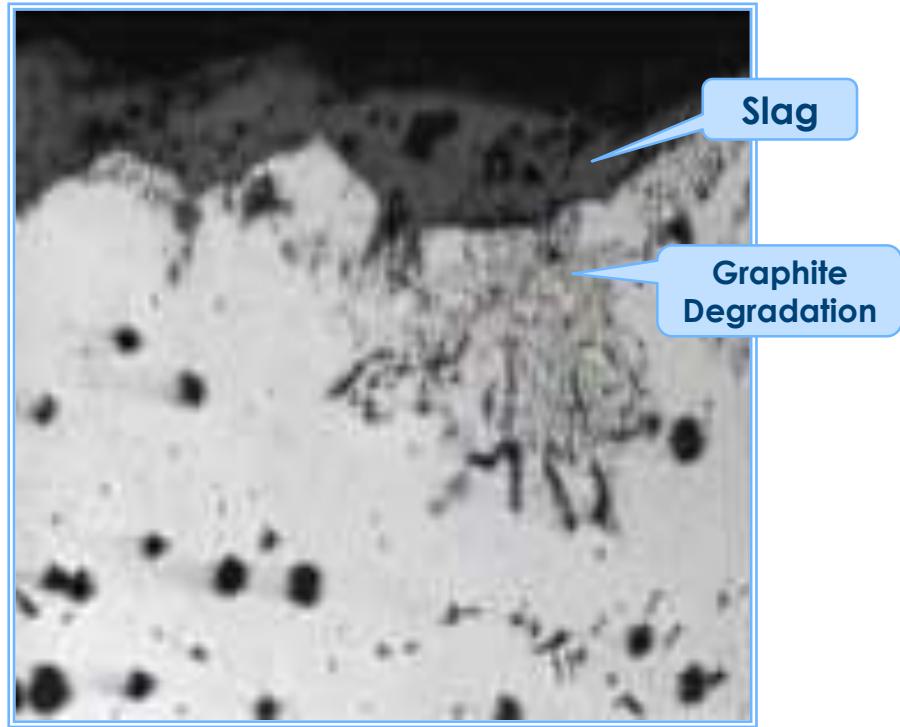
Fish Eye Defect



Defect

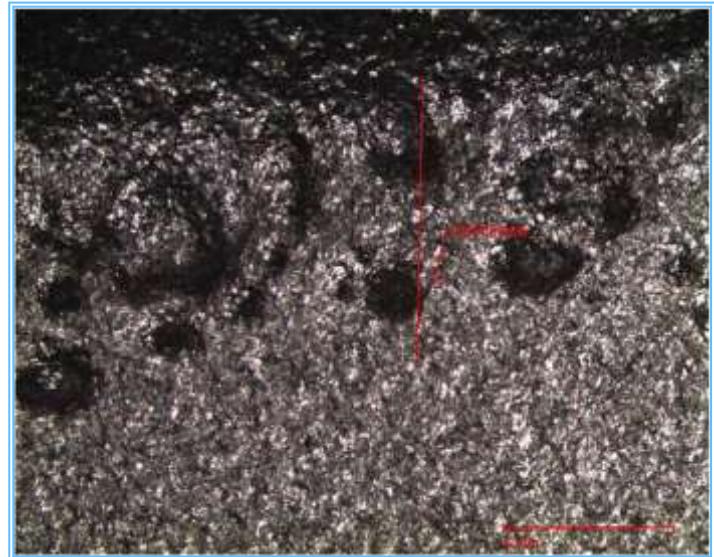


Fluorine Defect 100x

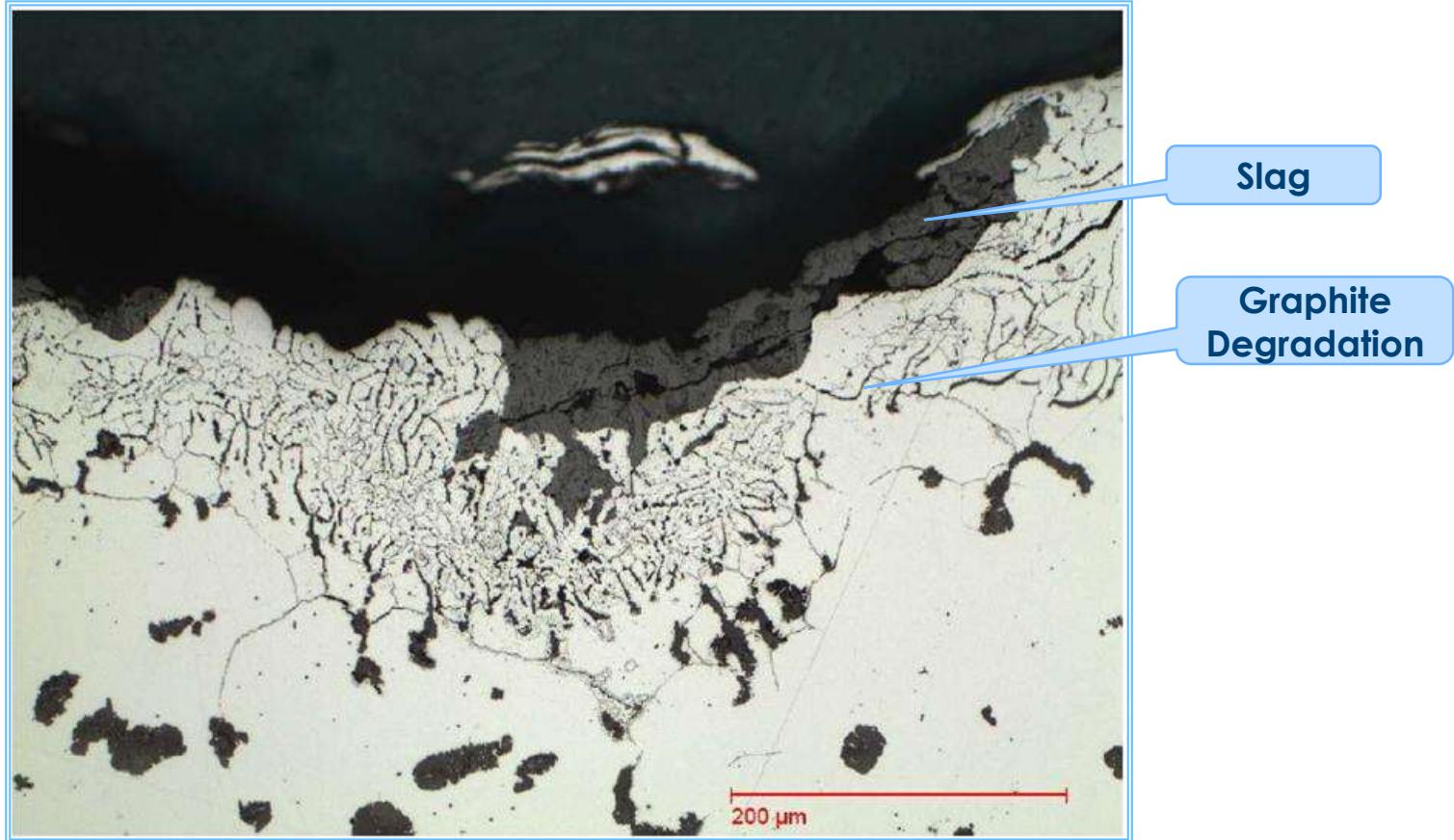


Fluorine in Green Sand

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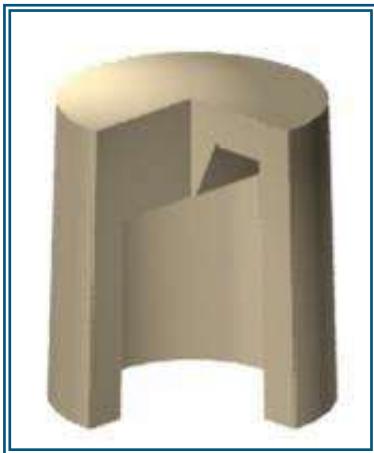
Fluorine Defect – 200X





Graphite Degradation

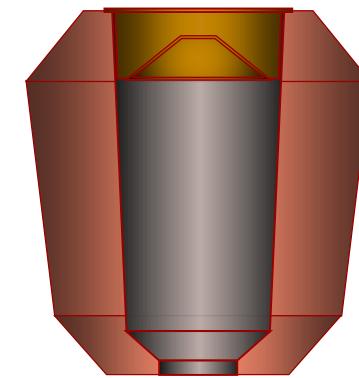
Graphite Degradation in contact with the casting, depending on the type of Sleeve



**Fibre Insertable Sleeve
WITH Fluorine**



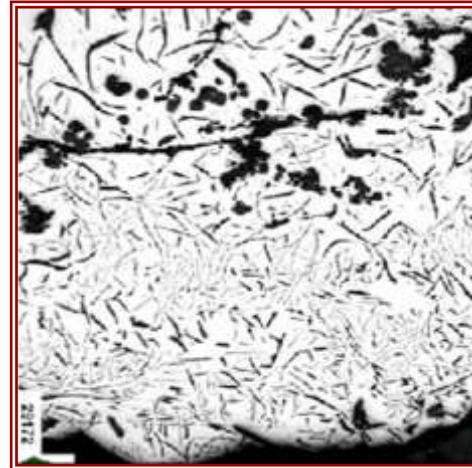
**Sand Mini-riser WITH Fluorine
and Shell Breaker Core**



**New EXACTCAST™
Mini-riser design W/O Shell and
Fluorine Free**



WITH Graphite Degradation



WITH Graphite Degradation

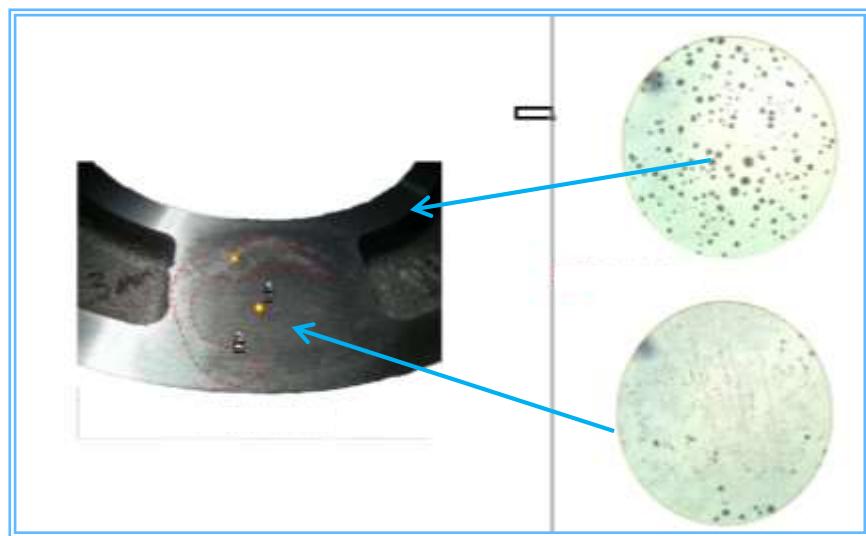


**EXACTCAST™ Fluorine Free
Avoids Graphite Degradation**

In some occasions, after machining the casting a dark area of graphite degradation can be seen



Example: Graphite Degradation under the sand sleeve due to fluorine content and excessive exothermia





Defects caused by the Sleeves Dimensional accuracy

“Tin Canning”

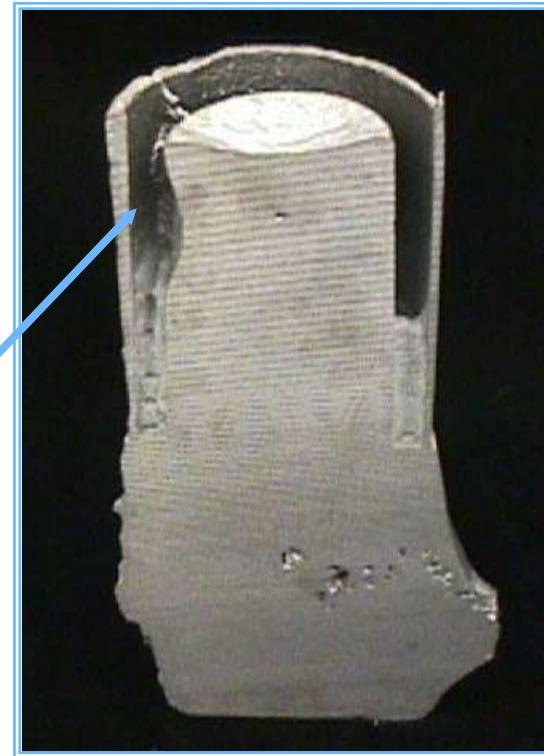


Cause:

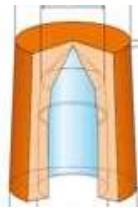
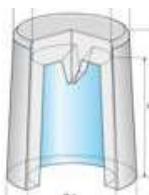
A gap between the sleeve and the mold fills with metal

Looks like a Tin Can

It can be covered at top also



Equivalence Relation among Insertables KI and KIM – In Mod



Mod (cm)	Insertable KI	Vol (dm3)	Vol (dm3)	Insert. Miniriser KIM	Mod (cm)
1,25	KI 4/7	0,070	0,030	KIM 4/7	1,30
1,30	KI 4/95	0,100	0,038	KIM 4/95	1,30
1,55	KI 5/8	0,130	0,075	KIM 5/8	1,60
			0,095	KIM 5/10	1,60
1,70	KI 6/9	0,180	0,135	KIM 6/9	1,80
1,80	KI 6/12	0,250	0,176	KIM 6/12	1,85
2,00	KI 7/10	0,300	0,200	KIM 7/10	2,10
2,25	KI 8/11	0,420	0,230	KIM 8/11	2,30
2,50	KI 9/12	0,580	0,430	KIM 9/12	2,60
2,80	KI 10/13	0,800	0,495	KIM 10/13	2,90
3,20	KI 12/15	1,350	0,850	KIM 12/15	3,30

2º Change: From Competition Fibre Cylindrical to EXACTCAST™ KMV Minirisers in PEP-SET™ Moulds

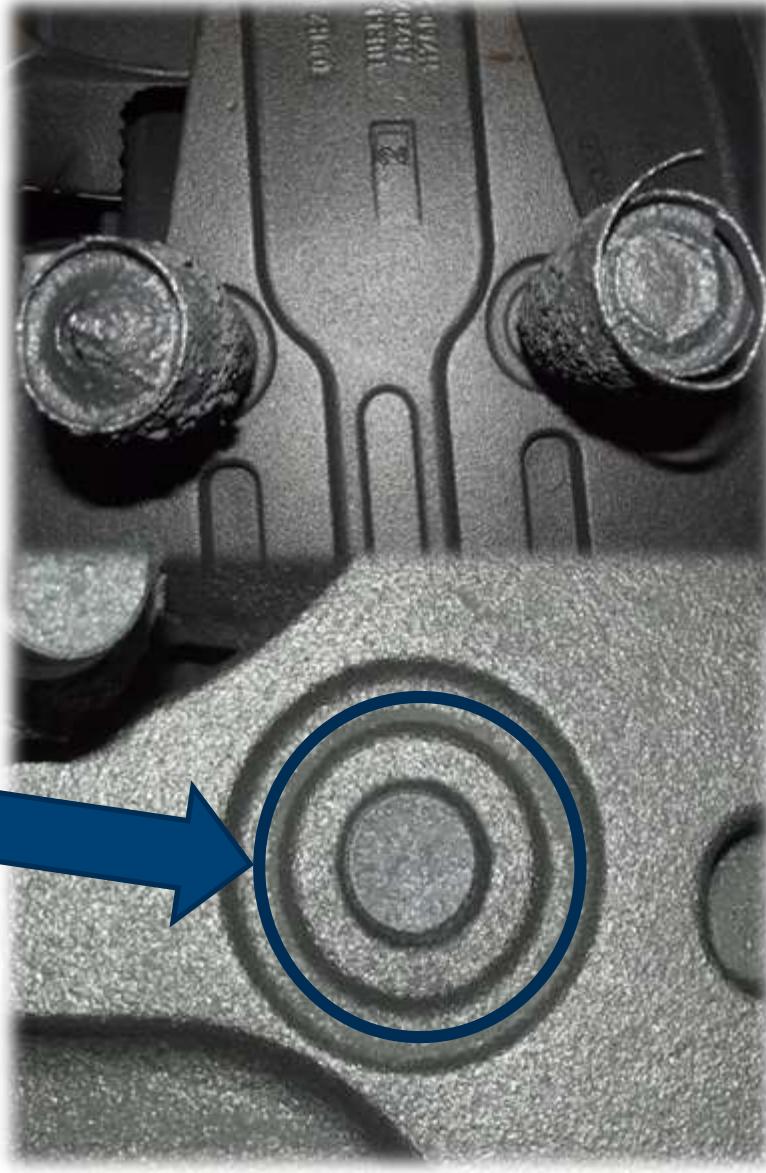
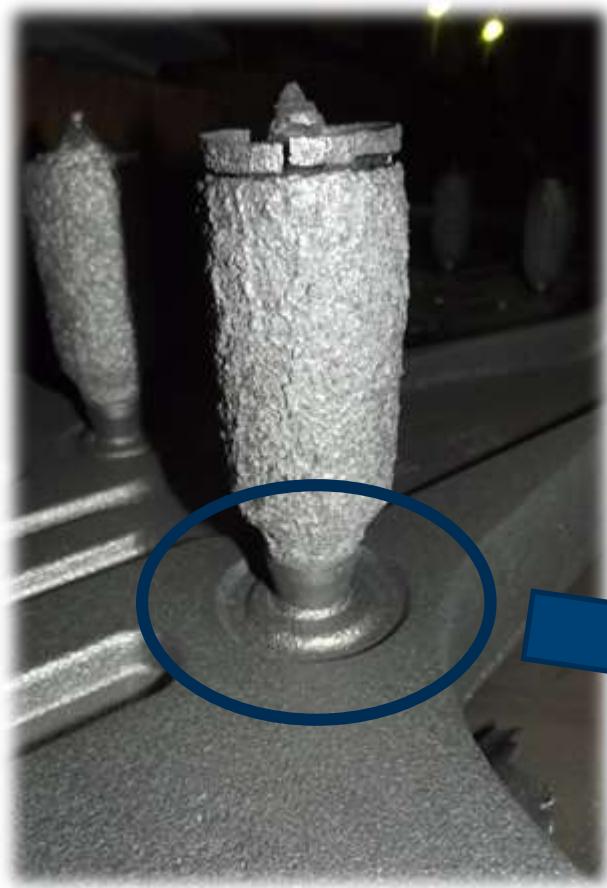




Defects caused by the Sleeves Particles

OPTIMA KL 86

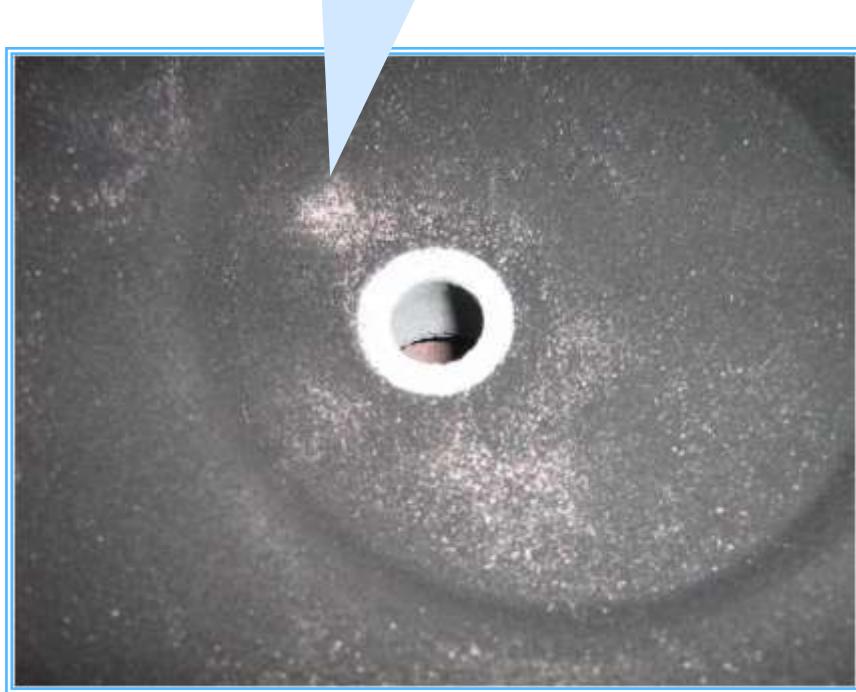
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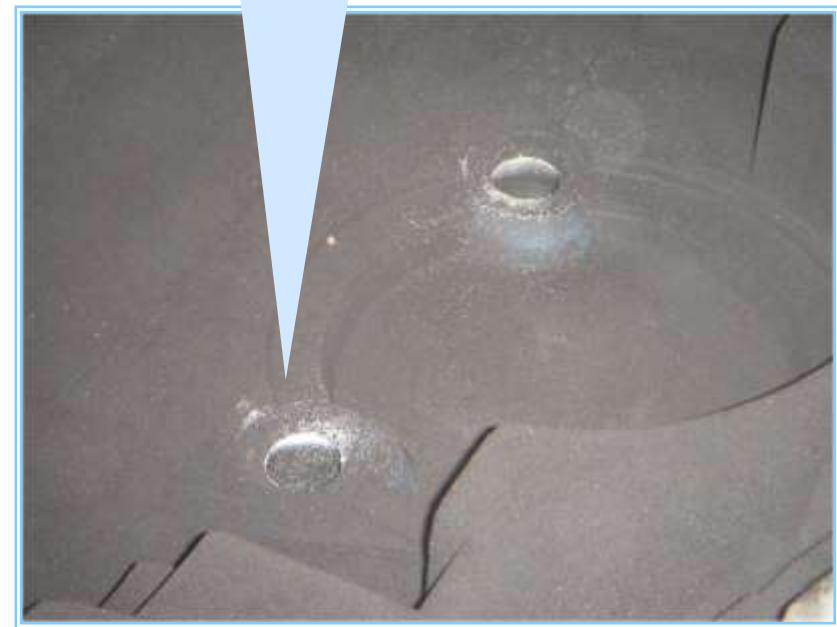
Inclusions created by the Sleeve material



Sleeve material coming
from the sleeve



Sleeve material coming
from the sleeve

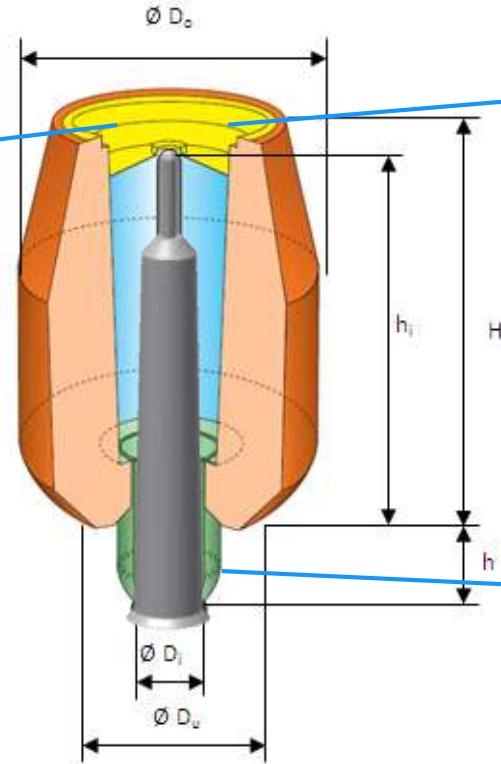


"The Solution"

EXACTCAST™ OPTIMA and KMV QP



EXACTCAST™
KMV QP



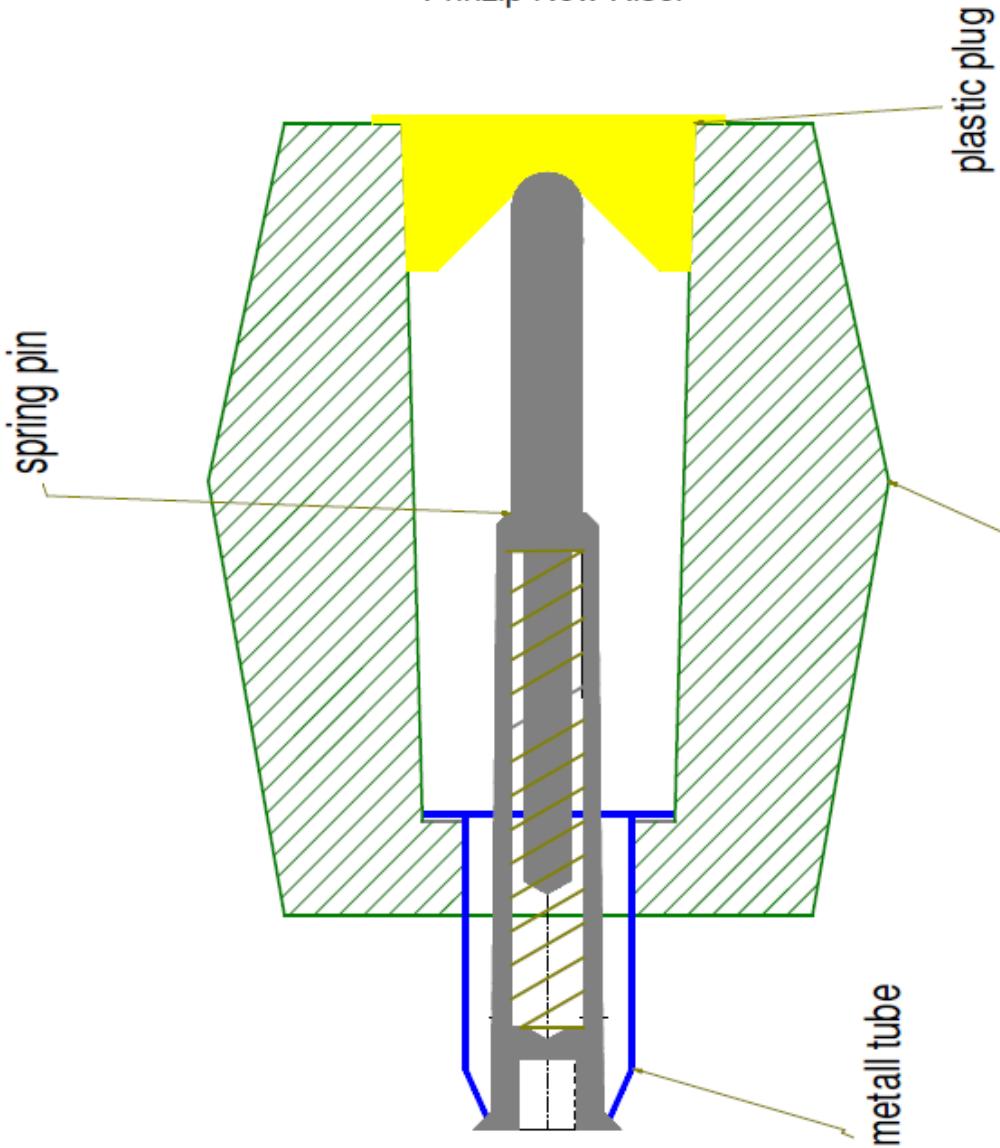
EXACTCAST™
OPTIMA CC
Fixed



EXACTCAST™
OPTIMA CC
Spring-pin



Prinzip New Riser



Application of Optima KL 111 Ex on COR 1707

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- ❖ There is not any surface problem on the casting
- ❖ The micro porosity under the riser disappeared

“The Advantage”: The New OPTIMA Technology



- ❖ **No dust or broken particles in the riser**
- ❖ **No dust or broken particles in the riser**

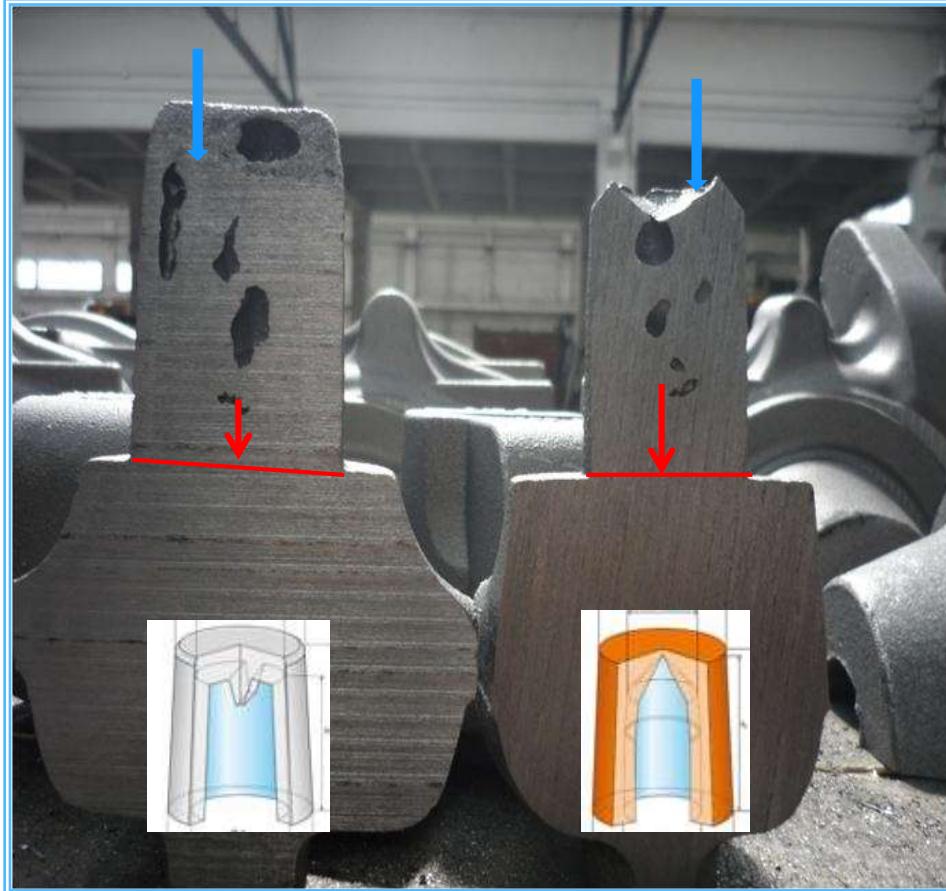


Test Result



130 cc

75 cc



It can be seen that the KI 5/8 riser is 130 cc versus 75 cc in the KIM 5/8.

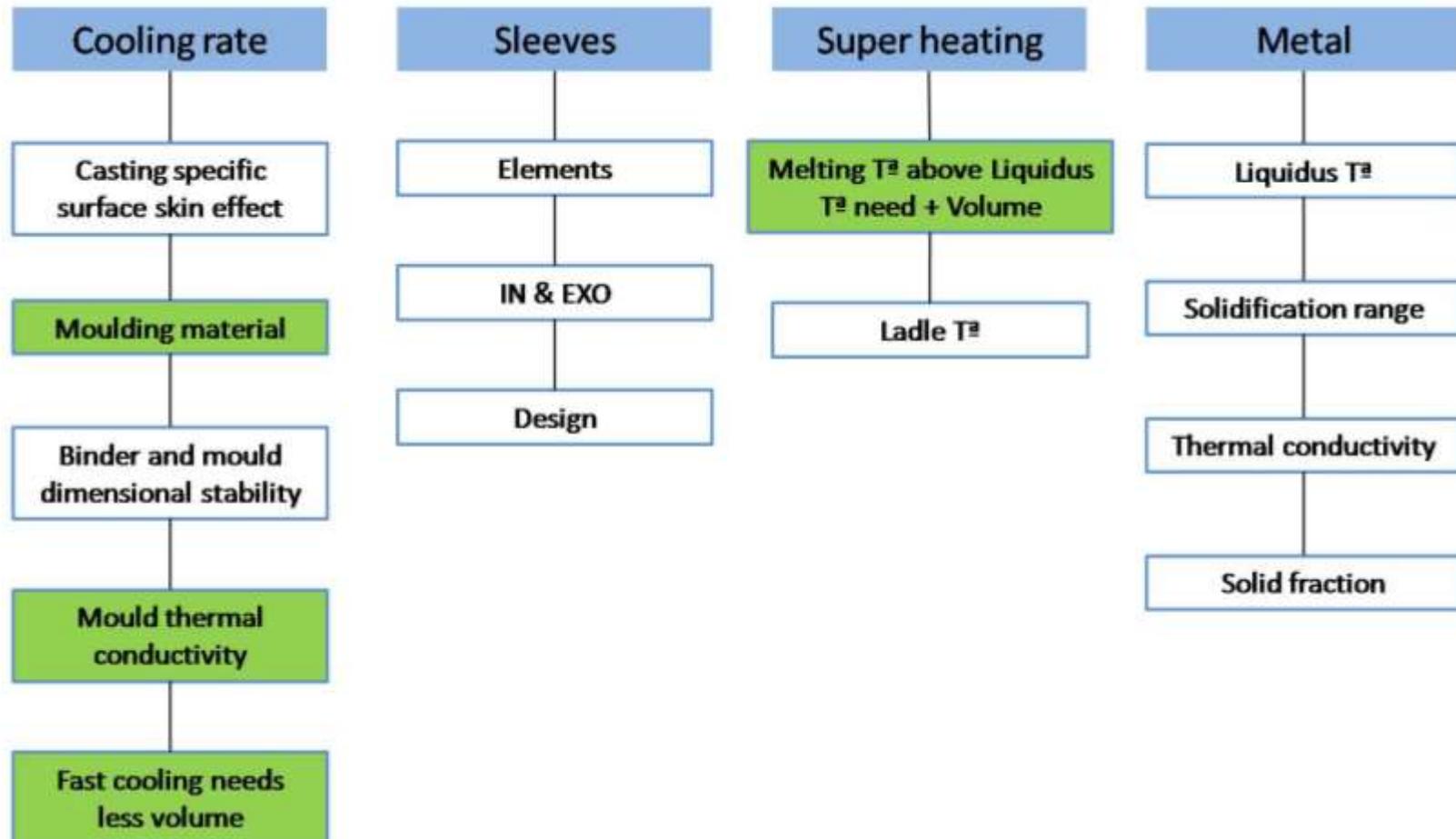
The safety margin in the KIM is better due to the fact that have a modulus bigger than the for the same exterior dimensions.

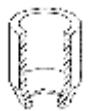
Experimental Process

Process Variables



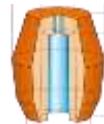
The foundry technology is characterized by the very many variables involved in the process





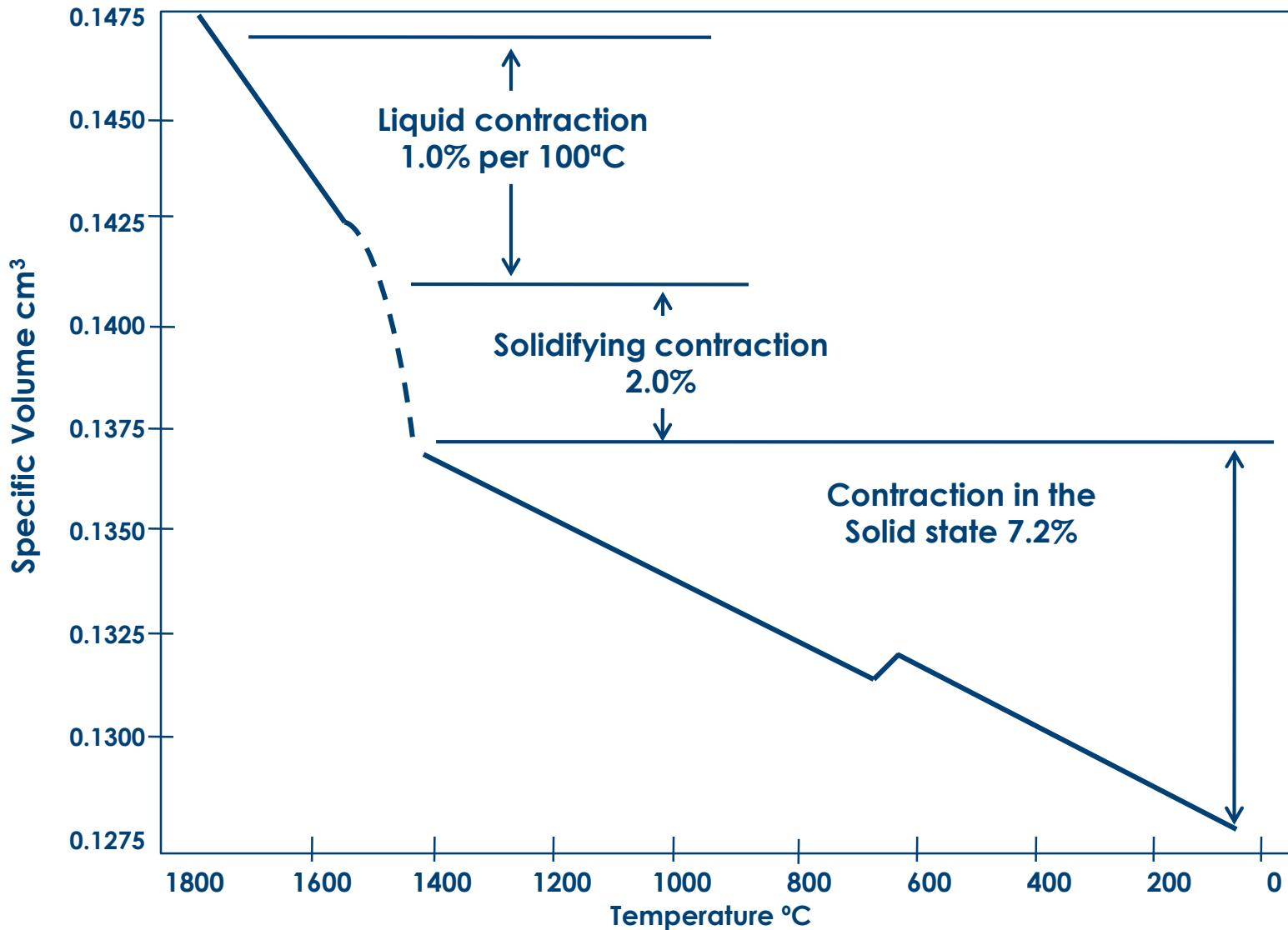
Mod	Neck Down			Cylindrical			Atmospheric			Closed Atmospheric Neck Down			EXACTCAST™ KMV Minirisers		
	Size	Mod	Vol	Size	Mod	Vol	Size	Mod	Vol	Size	Mod	Vol	Size	Mod	Vol
1,6	TA-0	1,6	0,18				55x85	1,7	0,17	55/110	1,7	0,16	KMV-88	1,7	0,09
2,0										60/130	2,0	0,30	KMV-121	1,9	0,12
2,2	TA-1	2,2	0,41				85x85	2,2	0,40				KMV--159	2,2	0,16
2,3							85x130	2,3	0,67	75/138	2,4	0,48	KMV-238	2,2	0,24
2,4	TA-2	2,4	0,48	80/150	2,4	0,70				85/142	2,6	0,59	KMV-191	2,5	0,19
2,6	TA-2R	2,6	0,80				85x170	2,8	0,89	100/150	2,8	0,85	KMV-339	2,8	0,34
2,8				100/150	2,8	1,20	100x100	2,8	0,71				KMV-339	2,8	0,34
2,9	TA-3	2,9	0,93				100x150	3,1	1,10	99/175	3,0	0,93	KMV-339 B	3,2	0,34
3,4	TA-4	3,4	1,40	120/150	3,2	1,70	100x180	3,2	1,35	109/180	3,3	1,39	KMV-339 B	3,2	0,34
3,8				140/200	3,9	3,1	125x190	3,9	2,00	125/182	3,7	1,63	KMV-590	3,8	0,59
4,1	TA-5	4,1	3,00				150x150	4,1	2,00				KMV-780	4,2	0,78
4,1	TA-5	4,1	3,00	160/200	4,3	4,0							KMV-1140	4,45	1,14
4,1	TA-5	4,1	3,00	160/200	4,3	4,0							KMV-1480	4,6	1,48
4,8	TA-6	4,8	5,10	180/200	4,6	5,1	150x200	4,7	3,20				KMV-1650	4,8	1,65
4,9				200/200	4,9	6,3							KMV-1650	4,8	1,65
5,1	TA-7	5,1	6,50										KMV-2565	5,2	2,57
5,5	TA-8	5,5	8,00	225/200	5,4	8,0							KMV-2565	5,2	2,57
5,5	TA-8	5,5	8,00	250/200	5,7	9,80							KMV-3100	5,5	3,10
6,3	TA-9	6,3	12,2	250/300	6,4	14,7							KMV-4300	6,2	4,30
7,0	TA-10	7,0	17,00	300/300	7,3	21,2							KMV-6800	7,5	6,80
7,7	TA-11	7,7	22,60	350/300	8,0	28,8							KMV-6800	7,5	6,80

Equivalence Relation between MINIS KMV and Cylindrical Sleeves – In Mod



d_{int}	D_{ext}	H	Vol (cm3)	Mod (cm)	CYLINDRICAL Sleeves	MINIRISERS EXACTCAST™ KMV	d_{int}	h	Mod (cm)	Vol (cm3)
80	110	150	700	2,4	X 3	KMV 339	65	120	2,8	340
100	140	150	1.200	2,8	X 4	KMV 339 B	65	120	3,2	340
120	160	150	1.700	3,2	X 5	KMV 590	80	125	3,8	590
140	180	200	3.100	3,9	X 6	KMV 780	80	165	4,2	780
160	205	200	4.000	4,3	X 7	KMV 1140	100	160	4,45	1.140
180	230	200	5.100	4,6	X 8	KMV 1480	115	155	4,6	1.480
200	250	200	6.300	4,9	X 9	KMV 1650	105	210	4,8	1.650
225	275	200	8.000	5,4	X 9,5	KMV 2565	110	295	5,2	2.565
200	250	300	9.400	5,4	X 9/300	KMV 2565	110	295	5,2	2.565
250	305	200	9.800	5,7	X 10	KMV 3100	120	300	5,5	3.100
275	330	200	11.900	6,0	X 10,5	KMV 4300	140	300	6,2	4.300
250	305	300	14.700	6,4	X 10/300	KMV 4300	140	300	6,2	4.300
300	360	200	14.200	6,2	X 11	KMV 4300	140	300	6,2	4.300
300	360	300	21.200	7,3	X 11/300	KMV 6800	175	300	7,5	6.800
400	465	500	63.000	10,0	X 13	KMV 9300	184	390	9,8	9.300
500	565	500	100.000	11,7	X 15	KMV 18400	230	495	12	18.400
600	670	600	169.800	14,5	X 17	KMV 34500	300	540	14,5	34.500

Volume change on cooling of a 0,35% C steel



Experimental Process

"Test Casting" design



The shape and dimensions of the Test Casting remain unchanged



Cooler ($\varnothing 200 \times 250$ mm)



Pouring



Miniriser

Results and Discussion

Solidification Rate



Cooling rate

When the solidification rate increases, the volumetric demand decreases

Identification	Sleeve	Riser Height (Sleeve Metal)	Chills
Test 7A	KMV 1650 (modulus 5,7 cm)	210	No
Test 7B	KMV 780 (modulus 4,2 cm)	165	Yes
Test 7C	KMV 590 (modulus 3,9 cm)	125	Yes



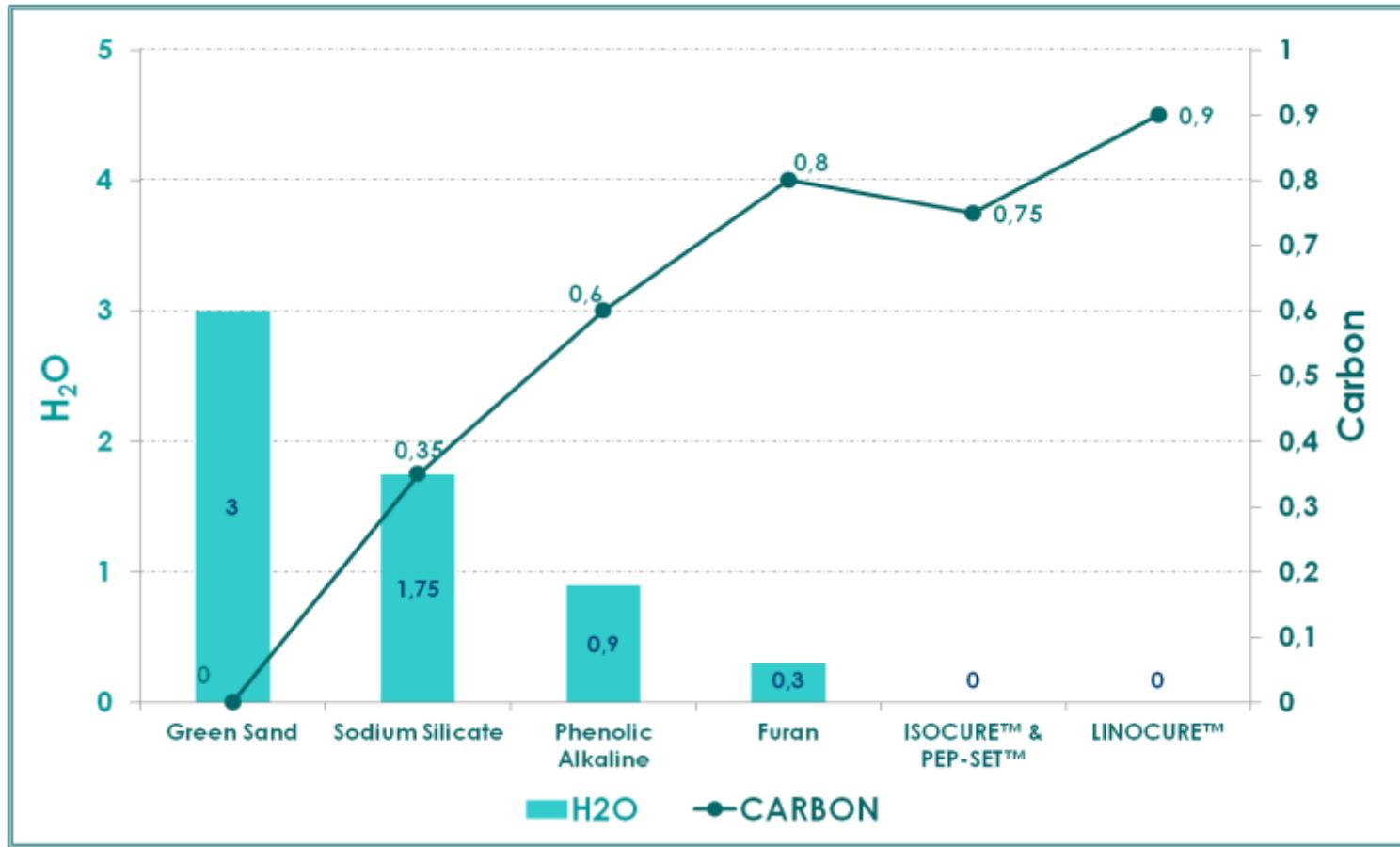
Results and Discussion

Moulding cooling



Mould material and thermal conductivity

The superheating rate results from the number of castings to be poured, using the same ladle and from the ISO EXO characteristics of the mould





Casting Weight: 1.620 kg
Saving: 689,4 kg



EXACTCAST™ KMV 256,5
Volume = 2,57 dm³
Weight = 20,56 kg
Modulus = 5,2 cm

AR 225x 200D Cylindrical Supplement
Volume = 8 dm³
Weight = 62,4 kg + 27,1 = 89,5
Modulus = 6,74 cm

Business success story: Stainless Steel Fdy

We solved their inclusions defect and increased their yield

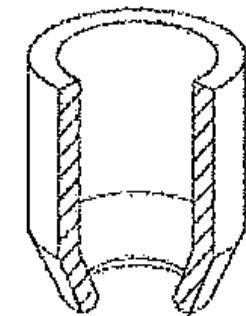
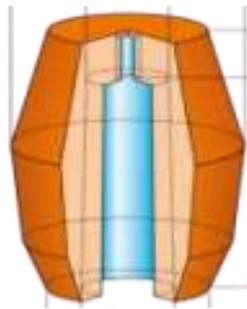
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**SS VALVE CASTING WITH FIBRE SLEEVES
AND INCLUSIONS
50% YIELD**

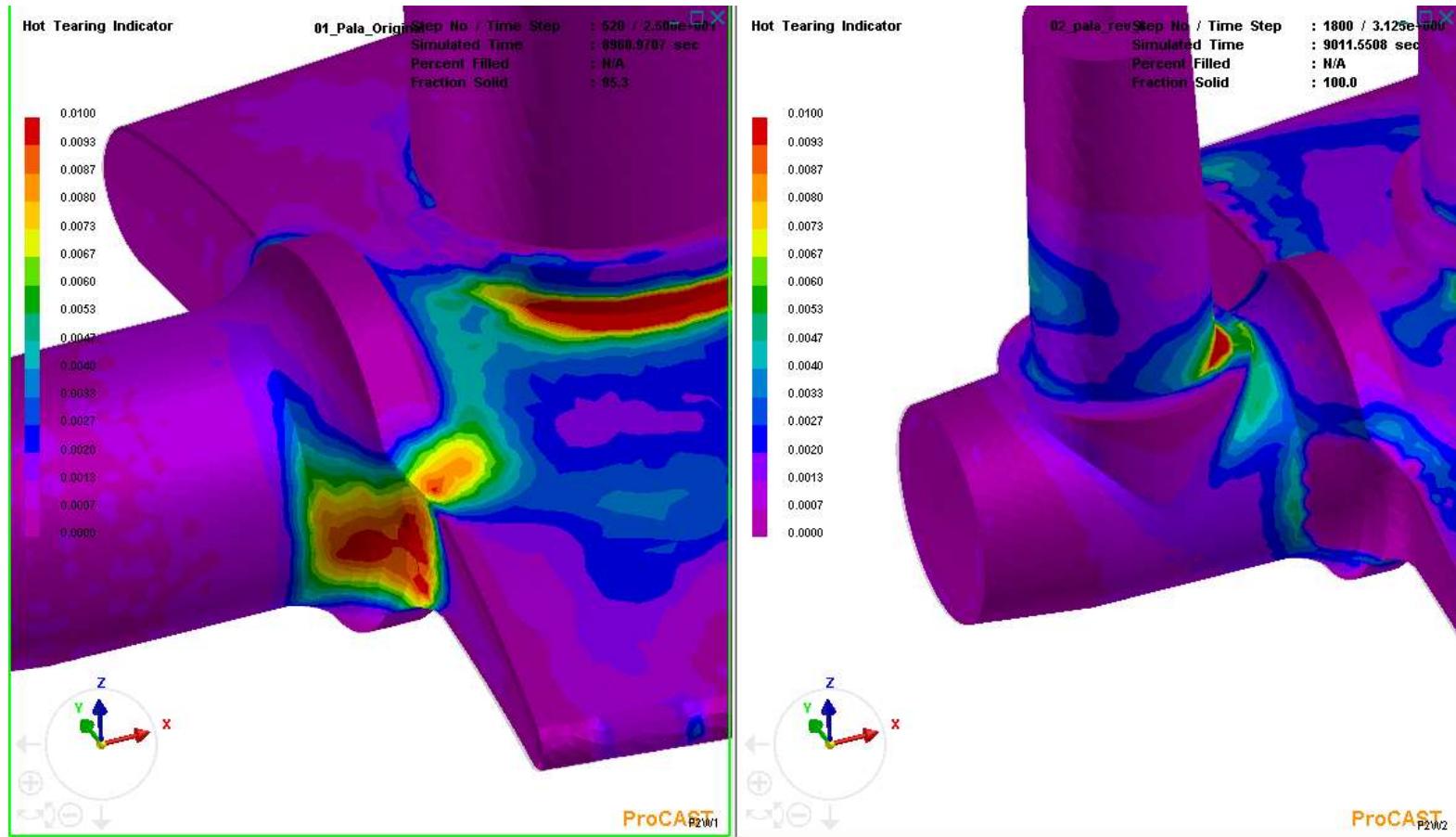


**SS VALVE CASTING WITH KMV
MINIRISERS INCLUSIONS FREE
65 % YIELD**



In this case it was not necessary to treat the casting before cutting due to its smaller section in relation to the fibre sleeves

Stress analysis. Hot-tearing indicator







EXACTCAST™ KMV 18000

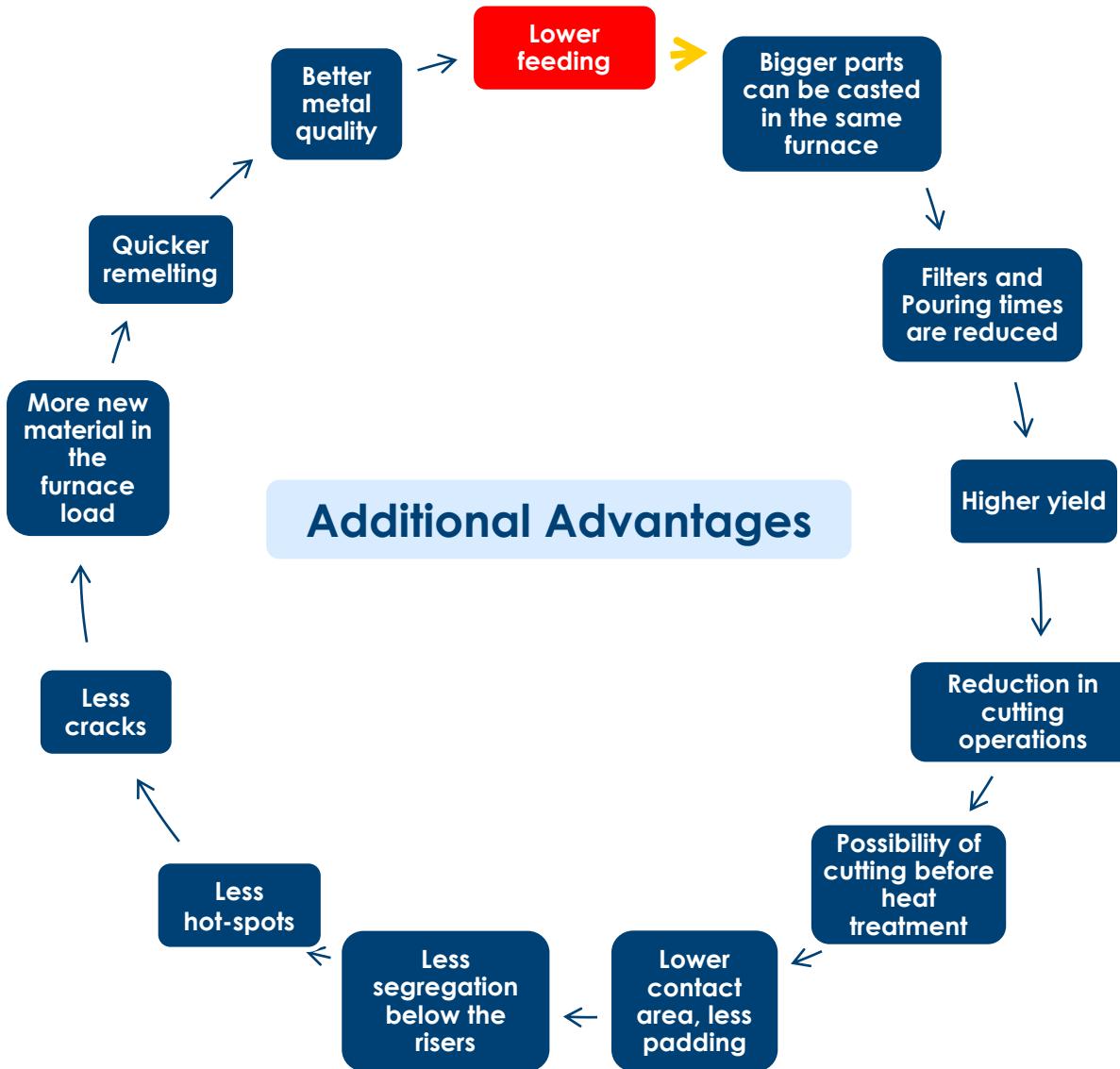
12.000 kg Steel casting



Carbon Steel – 10.200 kg net weight – 86% yield

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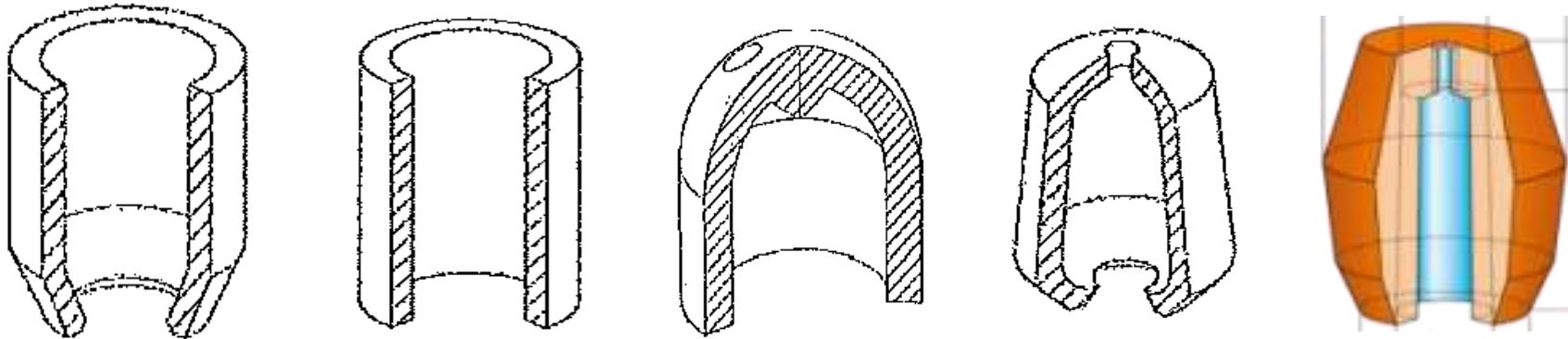
New Yield Objectives in the Steel Foundries using Minirisers:

- ❖ **Stainless Steel, Duplex y Superduplex foundries with radiographic quality: 65%**
- ❖ **Carbon Steel foundries with radiographic quality: 70%**
- ❖ **Carbon Steel foundries with standard quality: 75%**
- ❖ **Manganese Steel foundries: 85%**

Standard Yields with conventional feeding between 42% and 59%



CONCLUSION NEW MARKET SPACE CREATED FOR THE EXACTCAST™ MINIRISERS



In Steel with EXACTCAST™ KMV minirisers we can substitute every fibre sleeve shape. Just based on the same Modulus and at least 50% volume reduction overcoming the market barrier due to different shapes and volumes.

To reach higher yield is necessary to control the Foundry Variables.

End...



Questions???



Thank You for Your Attention!!!