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8. Uluslararası Döküm Kongresi / 8th International Foundry Congress by TUDOKSAD Academy In conjuction with Ankiros / Annofer / Turkcast fairs

#### «Çekinti Hatalarını Önlemede Parça Geometrisi ve Proses Dizaynının Önemi»

«Casting Geometry and Process Set Up With Focus on Shrinkage Defects»

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#### 1.Oturum: Döküm Sektöründe Rekabet Gücü

1st Session: Competitiveness of Foundry Sector

Oturum Başkanı/Session Chairman: Memiş Sağıroğlu (Trakya Döküm Sanayi Tic. A.Ş.)









# Iron Castings – Shrinkage A well known defect?

Influences of process, geometry and new part development







- Defect appearance
- Cast Iron Materials
- Casting geometry
- Moulding process with friendly support of







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### Appearance – Macro Shrinkage

#### **External shrinkage**

- At last solidified and almost at upper located areas of the mould. – As well at riser and ingate areas.
- Defect surface rough dendritic.
- Funnel shaped and often continuing insed the casting.
- Lack of material clearly visible.



#### Internal shrinkage

- Located at areas with huge wall thickness and / or wall thickness differences.
- Internal shrinkage has no connection to the surface.
- Irregular shape and rough dendritic surface.
- Detection by non-destructivetesting.



#### Sink mark

- Located at outer areas and transitions of sections.
- Frequent occurance with micro shrinkage together.



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### AGENDA

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## **Simplified solidification ribbon**







#### Grey cast irons

 Typical for volume deficite at grey cast irons are the differences at specific voluminas of its structural components.

Specific volumina	[m³/g]
Ferrite	0,1271
Iron carbide	0,1303
Austenite (C saturated)	0,1360
Graphite	0,4475

- In case of eutectic solidifcation, precipitated graphite is counteracting to shrinkage of the austenite.
- This enables by a certain share of Carbon, good degree of nucleation and solidifcation conditions a "self feeding effect".
- In case of huge share of eutectic precipitated graphite, this expansion can be more than the solidifcation contraction of the metallic phase – so total expansion will be possible.



#### GJL - Influence of Carbon saturation to shrinkage volume



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## Solidifcation – simplified representation



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#### Volume contraction vs. Temperature



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#### Volume contraction vs. Temperature



Temperature





### Further aspects at GJS



- Inoculation is a further important parameter Its Efficiency is temperature dependend and time limited.
- An almost eutectic composition, succesful inoculations are leading to precipitation of many small nodules - short pouring times at low temperature as possible are supporting reduction / avoidance of shrinkage.
- Thermal analysis equipment is supporting process guidance.





#### Further aspects on ductile materials



Microstructure by section



Source of information: Giesserei 07/2007



Source of diagramm: Sintercast – Dr. Steve Dawson





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#### **Casting oriented engineering**





#### **Evaluation of casting geometry**





## **Development of risering**



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Man



#### **Solidification**







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# **Animation moulding process**









## Sand shoot high speed slow motion

#### Shooting pressure 1bar

**Shooting pressure 2bar** 









## Sand shoot simulation



- Simulation software for moulding line is currently under construction.
- Trials and investigations brought up, that existing simulation software need to be developed further.



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# Thank you for your attention! Any question?

