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**8. Uluslararası Döküm Kongresi / 8th International Foundry Congress by TUDOKSAD Academy**  
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**«Refrakter Esaslı Boyaların Kullanımı ve Döküm Hatalarına Etkileri»**

**«Coating Application As A Source of Errors At The Foundry»**

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**4.Otulum: Döküm Teknolojileri Kalıp**  
**4th Session: Moulding Technologies**

**Otulum Başkanı/Session Chairman: Bülent Şirin (Componenta Dökümcülük Tic. San. A.Ş.)**



Oturlumlarda yer alan sunumlar 3 Ekim 2016 Pazartesi tarihinde akademi web sayfasına ([akademi.tudoksad.org.tr](http://akademi.tudoksad.org.tr)) yüklenecektir.

# **Coating Application as a Source of Errors at the Foundry**

*8<sup>th</sup> International Foundry Congress - Ankiros*

# Introduction



Veining Defects



Metal Penetration



Scab Defects

# Influencing Factors

- Preparation of the coating
- Viscosity / Efflux time
- Temperature of the coating
- Cleanness
- Moulding system
- Refractoriness of the coating

**What are the settings for the optimum properties of the coating to avoid casting defects?**

# Influencing Factors - Preparation of the coating

- Delivery of the coating in different kinds of containers
- Settling of heavy refractory materials during transport and storage of the coating
- Therefore first:
  - stirring and homogenizing the undiluted coating
- Thereafter:
  - filling of coating in the preparation container / dipping tank
  - diluting of coating

**Purpose: Homogeneous quality of the coating**

# Influencing Factors - Problems of Preparation



- Bent or missing propeller
- Wrong direction of rotation (correctly: clockwise)
- Unsuitable mixer (wrong dimensions, e.g. shaft too short)

**Reduced stirring power**

# Influencing Factors - Problems of Preparation

- Mixing times too short
  - Uneven Mixing
  - Uneven application of the coating
- Recommendation: approx. 1-2 hours of continuous operation at containers (1000 litres)
- Then: Adjust mixer for intermittent operation (e.g. 10 min per hour)

# Influencing Factors - Viscosity / Efflux time

- Layer thickness affects protection against casting defects
- Dilution affects the layer thickness
- Matt time controls drops and runners

Dilution 100g Arkopal A with water [g]	Weighted Density [g/ml]	Spindled Density [°Bé]	Efflux Time 4mm [g]	Layer Thickness wet [µm]	Matt Time [s]	Solid Content [%]
37	1,263	38	13,2	350	96	33,7
40	1,258	35	12,9	325 – 350	88	33,3
44	1,249	33	12,6	325	77	32,3
49	1,239	32	12,2	300	61	31,3
58	1,223	29	11,8	275 - 300	57	29,4



# Influencing Factors - Viscosity / Efflux time

- Efflux time too low -> Low layer thickness
  - Risk of casting defects
    - Veinings
    - Metal penetration
- Efflux time too high -> High layer thickness
  - Bad application properties
    - Formation of drops and runners
    - Wall thicknesses too thin

**Regular control and documentation of the coating**

# Influencing Factors - Temperature

Temperature of the coating [°C]	Solid Content at 12,5 s [%]	Temperature of the core [°C]	Application Weight [g]		Layer Thickness [µm]	
			Wet	Dry	Wet	Dry
30,0	50,6	30	16,9	8,5	225	145
			16,8	8,4	225	146
		7	15,8	7,8	175	129
			16,8	8,3	200	141
21,0	50,0	21	17,5	8,4	150	115
			17,1	8,0	150	104
		7	16,6	8,0	150	115
			15,9	7,8	150	125
13,0	48,5	21	16,4	7,7	125	117
			16,9	7,9	125	104
		13	16,0	7,3	125	109
			16,3	7,3	125	112
		7	18,2	8,5	100	86
			17,4	7,8	125	98
7,0	47,2	21	17,9	8,1	125	89
			16,8	7,5	125	82
		7	15,4	6,9	125	84
			15,8	7,0	125	87

- High impact of the coating temperature
- Low impact of the core temperature

**Increased reworking possible by lower layer thicknesses**

# Influencing Factors - Cleanness

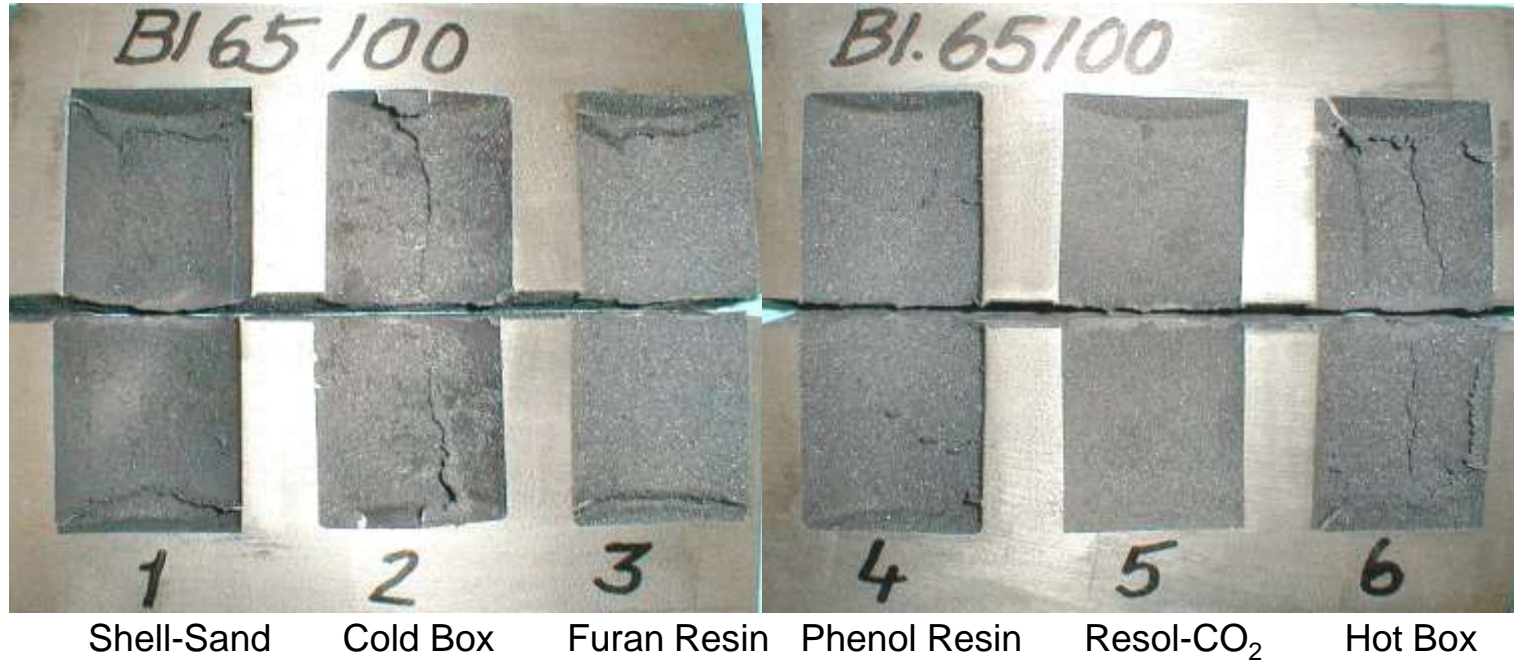
## Prevention of bacterial contamination (only for water based coatings)

- Bacteria enter the coating in many ways
  - Air
  - Water
  - Bacterial films to system components
- Change of the coating properties
  - ➔ **Poor flowability**
  - ➔ **Foaming**
  - ➔ **Poor adherence**



# Influencing Factors - Moulding system

## Anti-Veining Test Block



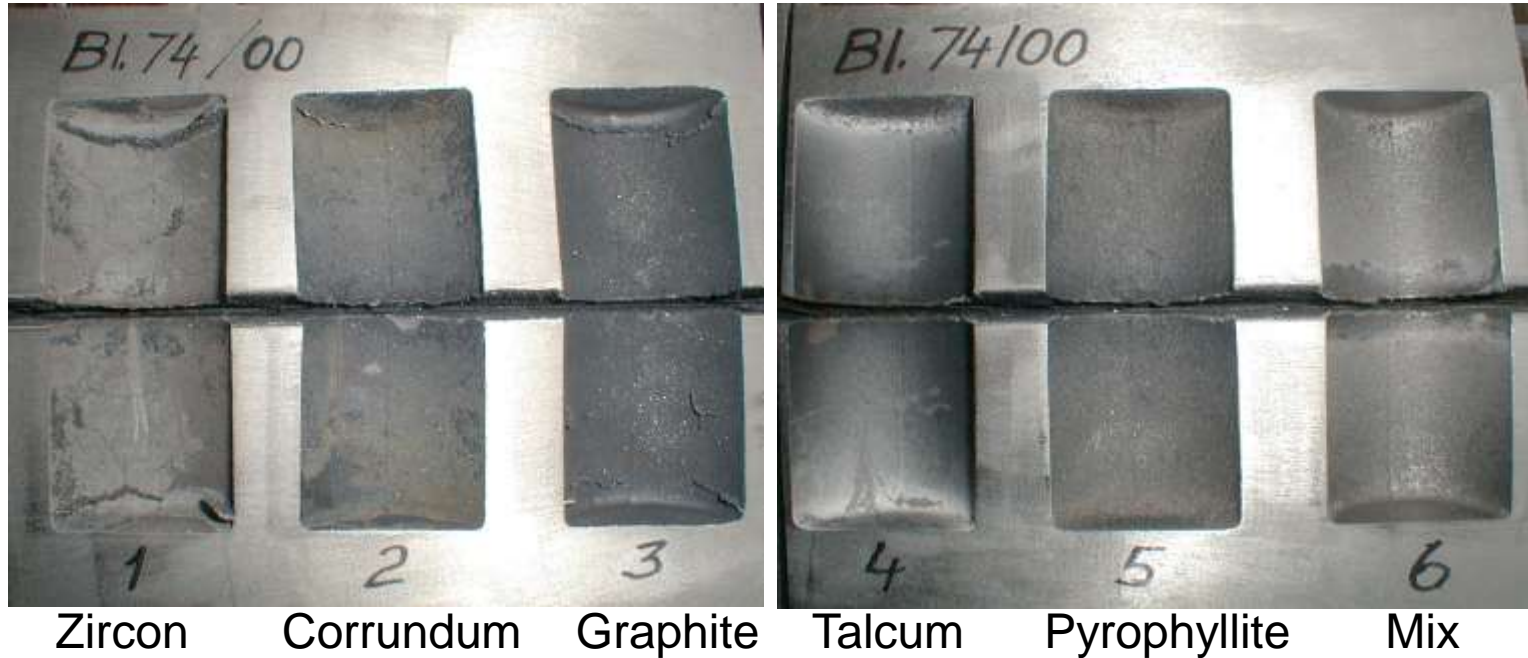
# Influencing Factors - Refractoriness of Coatings

Raw Material	Density [g/cm <sup>3</sup> ]	Melting Point [°C]	Grain Shape	Formula
Kaolinite	2,65	> 1700	plate structure	Al <sub>4</sub> [(OH) <sub>8</sub>  Si <sub>4</sub> O <sub>10</sub> ]
Pyrophyllite	2,80	1600	plate structure	Al <sub>2</sub> [(OH) <sub>2</sub> Si <sub>4</sub> O <sub>10</sub> ]
Talcum	2,80	max. 1430	plate structure	Mg <sub>3</sub> [(OH) <sub>2</sub> Si <sub>4</sub> O <sub>10</sub> ]
Mica	2,85	> 900	plate structure	KAl <sub>2</sub> [(OH) <sub>2</sub> AlSi <sub>3</sub> O <sub>10</sub> ]
Zircon	4,60	2200	angeld	ZrSiO <sub>4</sub>
Graphite	2,1 - 2,3		flaky	C (70 - 95 %)
Silica	2,60	1700	splintery	SiO <sub>2</sub>

Grain size and shape of a raw material affects properties like permeability, anti veining properties or peel off behaviour

# Influencing Factors - Refractoriness of Coatings

Test casting: Silica sand H32, 1,1 PBW No Bake Resin, 0,4 PBW Activator



# Defect Prevention - Measuring Methods

## Viscosity measurement

- Viscosity cup: 3, 4, 6 mm in [s]
- + fast and easy measurement method, medium accuracy
- operator dependent, result variation depending on supplier



## Density measurement

- Baumé stick in [°Bé]
- + fast and easy measurement method
- operator dependent, result variation depending on measuring device, low accuracy



# Defect Prevention - Measuring Methods

## Density by weight

Density cup in [g/ml]

- + fast and easy measurement method, medium to high accuracy
- operator dependent



## Layer Thickness measurement

Wet Film Thickness Gauge in [ $\mu\text{m}$ ]

- + fast and easy measurement method, sufficient accuracy
- operator dependent



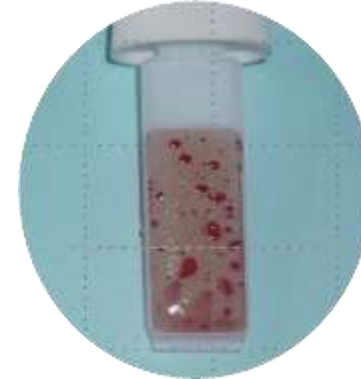


# Defect Prevention - Measuring Methods

## Measurement of Bioburden

### Agar Strips

- + easy measurement method, detection of bacteria and fungi
- 2 – 4 days incubation



## OAS SCCD System (Modular system)

### Automatic density measurement

- + reliable process with high accuracy, operator independent, possible to change coating viscosity rapidly
- High Investment



# Defect Prevention - Automation



OAS SCCD System  
(Self Calibration Coating Device) =  
Automatic density measurement

- Modular system for dipping, flooding or spray application
- Measurement instruments outside the tank system
- Closed tank in order to avoid bacterial growth and solvent evaporation
- Optimal agitation system to avoid sedimentation and foam

# Summary

Good casting results are obtained with:

- Use of a suitable coating
- Controlled coating preparation and dilution
- Homogeneous and uniform coating application
- Regular quality checks of appropriate measurement methodology

**Thank you for your attention!**