

“The Only Thing That Is Constant Is Change”

- Heraclitus of Ephesus, 520-460 B.C.

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23-24 April 2019



Mines



Smelters



Zinc



Copper

Overview

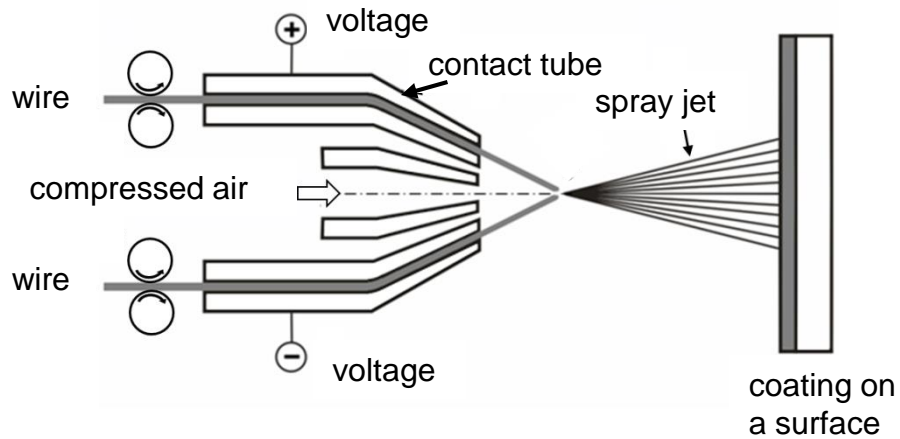
- **Work Experience**
 - Thermal Spraying
 - General Galvanising

- **New challenges for General galvanizers**
 - New restrictions
 - New steel compositions
 - ...

Work Experience

- **Working with zinc since 2012**
- **Corrosion engineer at**
 - **University of Applied Sciences, Iserlohn, Germany**
 - **Institute for Maintenance and Corrosion Protection Technologies n.f.p.Ltd (IFINKOR), Iserlohn, Germany**
- **Since March 2018 with Boliden**

Thermal Spraying



Steel Bridges



Energy



Marine & Shipping



- Galvanizing of large or otherwise difficult to galvanize steel structures.

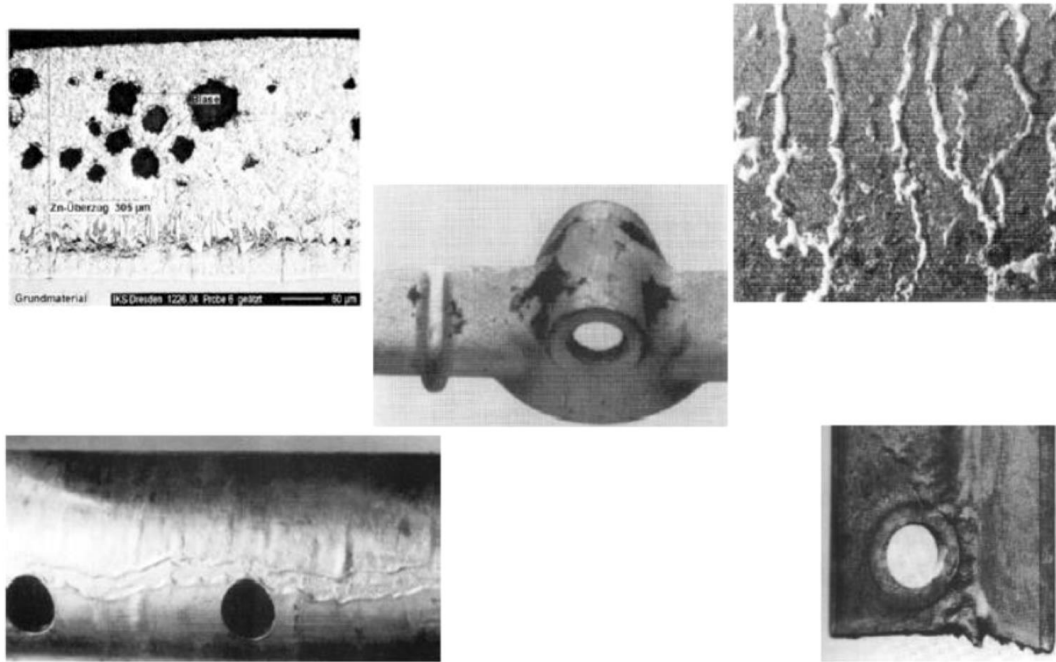
General Galvanising

- **Research project**
 - Influence of different alloying elements on visual surface appearance and corrosion behaviour
- **Quality control**
- **Investigations in the case of damage**
 - Corrosion
 - Black spots
 - Deformation of products
 - ...

New challenges for General Galvanizers

- **New restrictions**
 - “Lead-free”
- } Nordic Galvanizers are more experienced in lead-free galvanizing
- **New steel compositions**
 - Al-killed steels
 - High Alloyed steels
 - Internal oxidation
 - **Effect on wettability and coating growth**

Reduction of lead changes the physical properties of the Zn-melt



- Pb, Sn, Bi (~~and Sb~~) are acting on:
 - Viscosity
 - Surface tension
 - Wettability

Physical properties of a Zinc Melt

- **Viscosity:**
 - Low impact of Pb, Sn and Bi
 - Pb-equivalent viscosity = Pb + 2,5 Sn + 2,5 Bi
- **Surface tension:**
 - Huge impact of Bi
 - Pb-equivalent surface tension = Pb + 0,15 Sn + 6 Bi
- **Wettability**
 - High impact of Sn
 - Pb-equivalent wettability = Pb + 3 Sn + 2 Bi

Aluminium killed steels

- **Al-killed steels in order to facilitate laser cutting**

C (max %)	Si (max %)	Mn (max %)	P (max %)	S (max %)	Al (min %)
0.10	0.03 ¹⁾	1.50	0.025	0.010	0.015

- ¹⁾ **Domex 355MC (SSAB): category A (thin coatings) for hot-dip zinc-coating in EN 10149-2.**
- **Category B: (thick coatings) is available on request (Si 0.15-0.21%).**
- **Al (>~0.04%) => low coating thickness below ISO 1461**
- **In collaboration with the Association “nordic GALVANIZERS” investigation of origins**

Aluminium killed steels

- **Results of ongoing investigations**

- **Chemistry of steel:**

C	Si	Mn	P	S	Al
0.071	0.01	0.590	0.006	0.004	0.051

- **Galvanizing test in 2 plants (by nordic GALVANIZERS):**

- comparable pre-treatment,

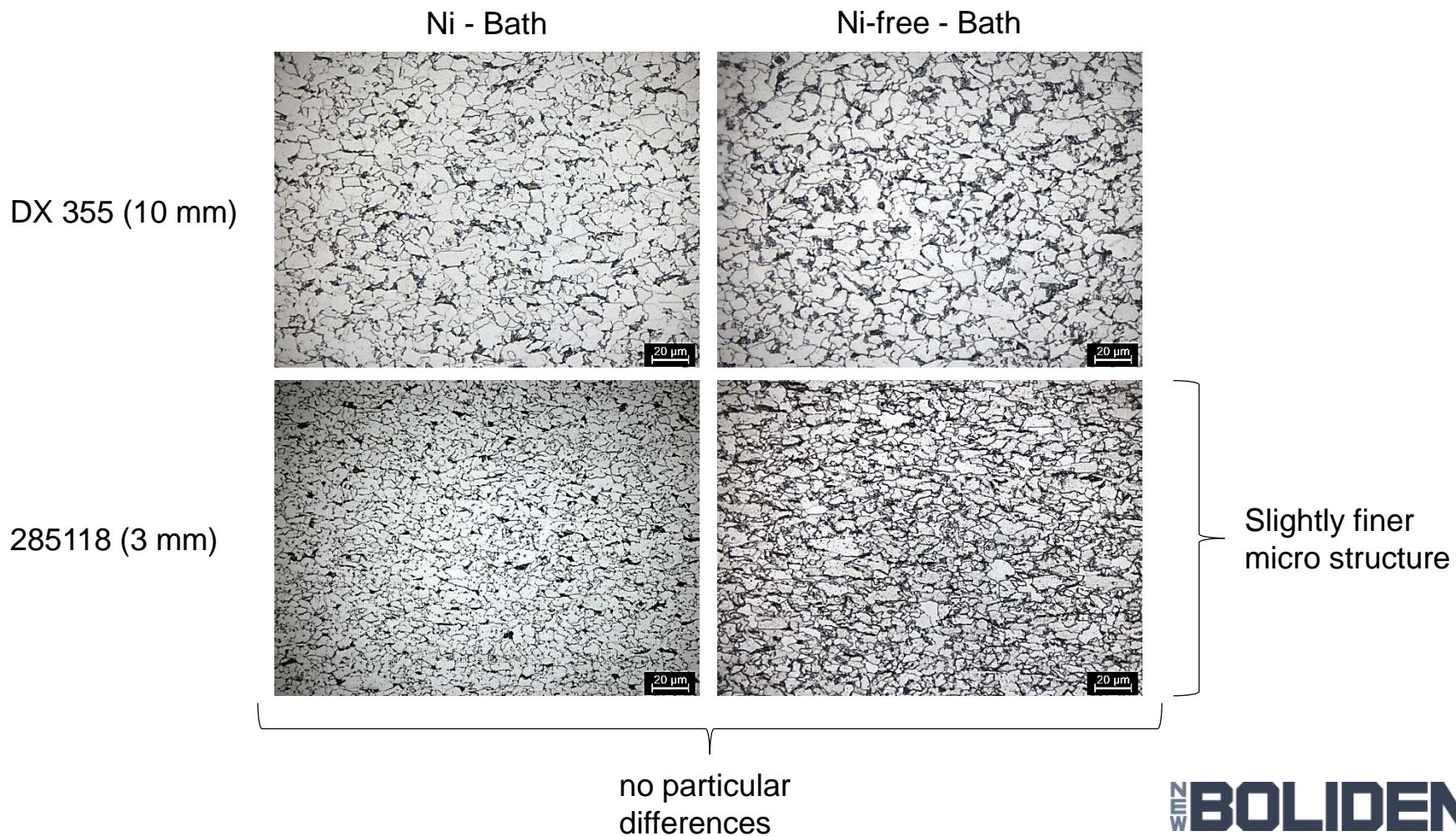
Degreasing	Pickling	Fluxing
10 min	37 min	2 min

- differences in dipping time, Zn melt, material (thickness)

Dipping time	Zn melt	Material (thickness)
2,67 min	Ni; Ni-free	285118 (3 mm)
2,67; 5; 10 min		DX 355 (10 mm)

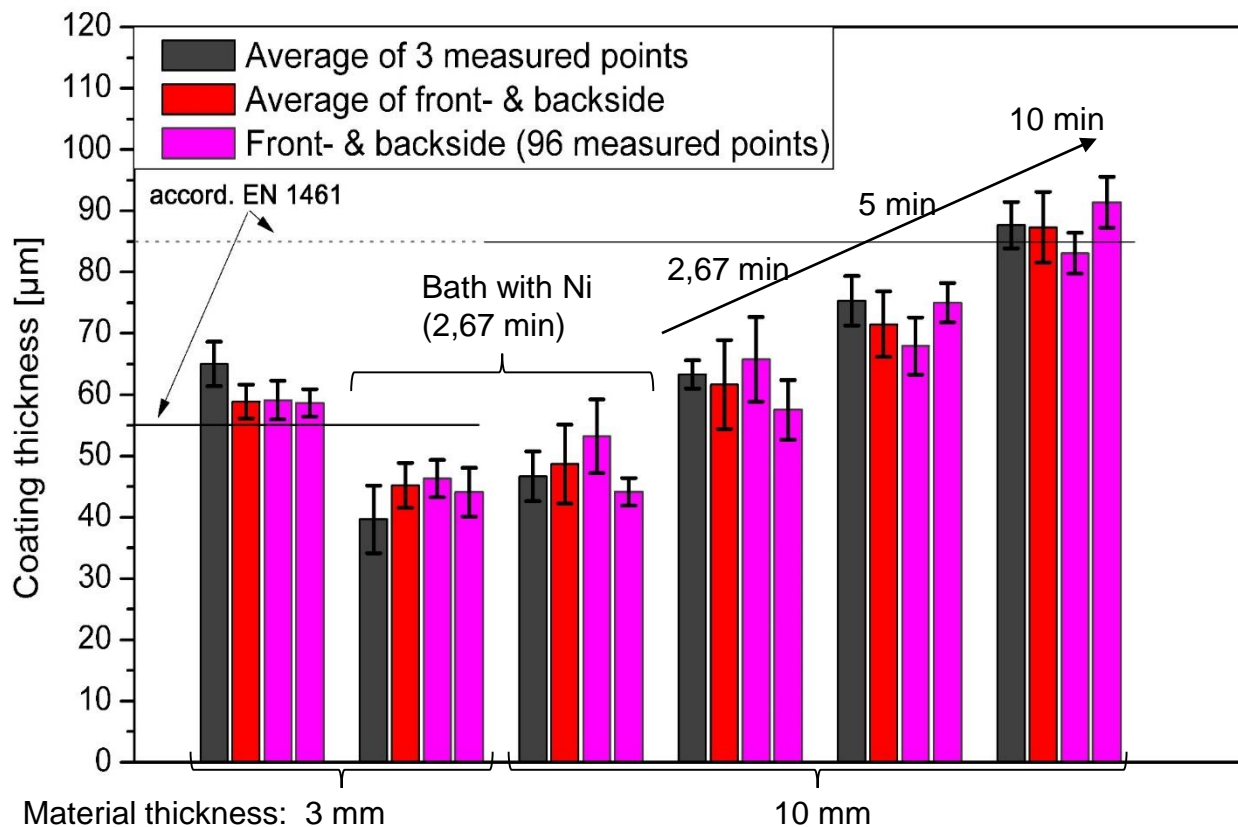
Aluminium killed steels

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Aluminium killed steels

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Front- & backside:

- 10 mm: differences in the coating thickness

Coating growth 3 mm / 10 mm:

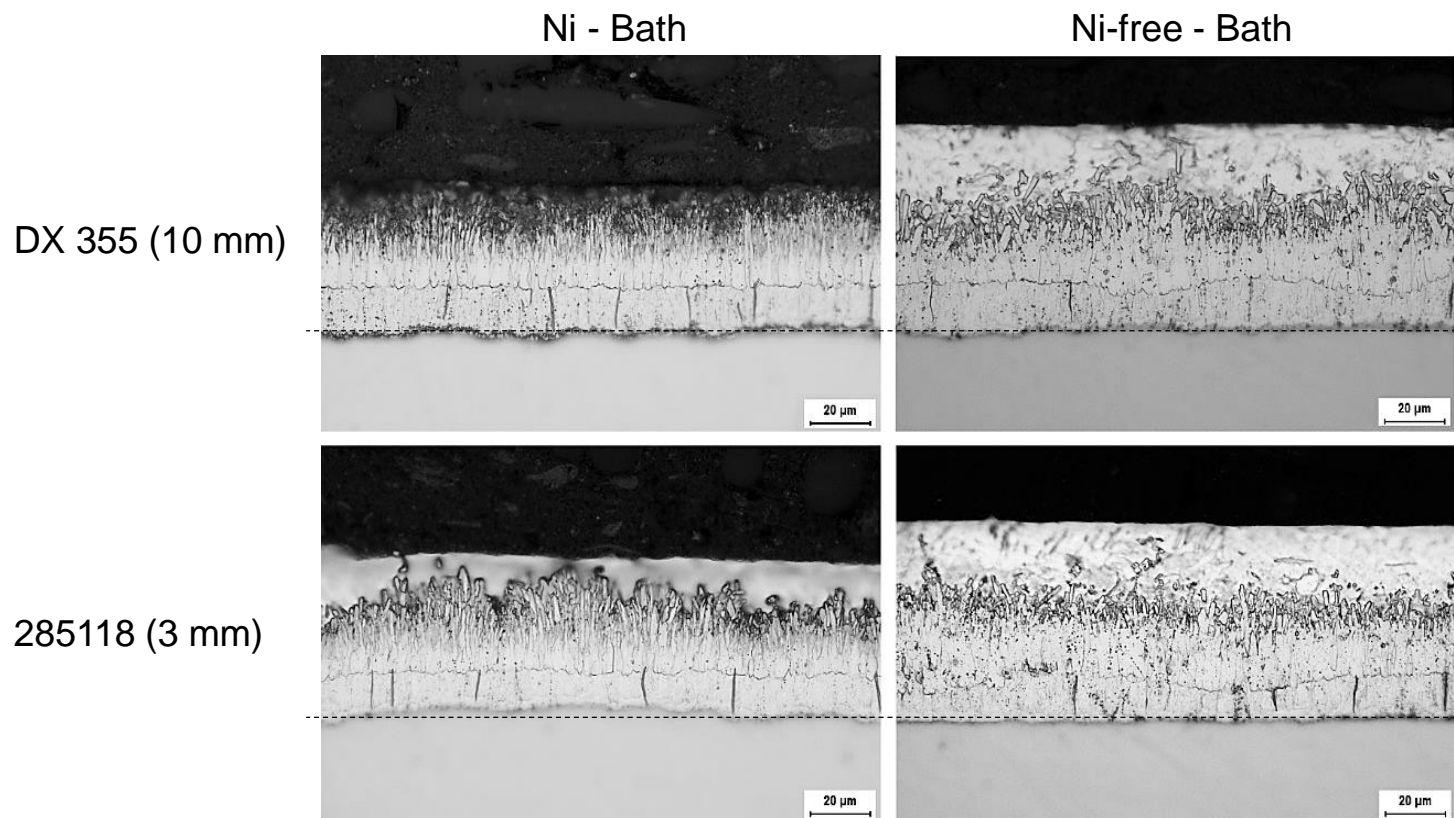
- no clear difference
- 55 µm possible after 2.67 min dipping time
- 85 µm possible after more than 10 min dipping time

Ni / Ni-free:

- Difference in the coating thickness: 12,9 – 13,7 µm for a dipping time: 2.67 min

Aluminium killed steels

- Results of ongoing investigations



- Ni- coatings show low amount of withdrawn Zinc (η -phase)
- Difference in galvanizing process?

Thanks for your attention!

Questions?

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