ESTEP SPRING DISSEMINATION EVENT

17-18 FEBRUARY 2026 - BRUSSELS (BELGIUM)

ESTEP

CONTENT

- Introduction
- Characterization of Work Rolls Contamination
- Effect of Process Parameters on Zinc Fouling
- On-Line Measurement System
- Laser Cleaning of Work Rolls
- Optical Microscopy and Roughness Measurements
- Conclusion and Next Steps

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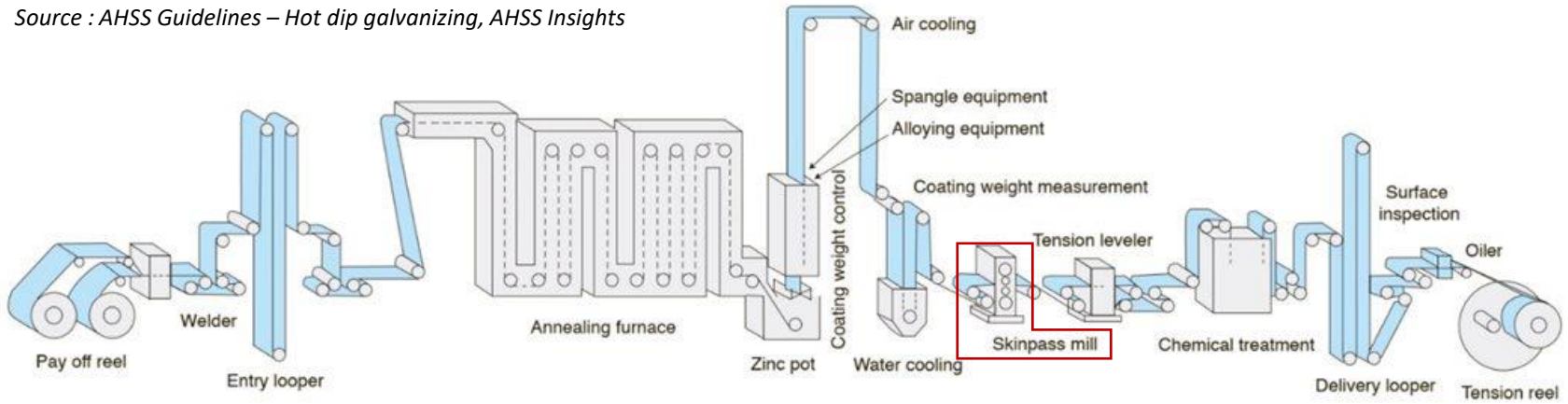
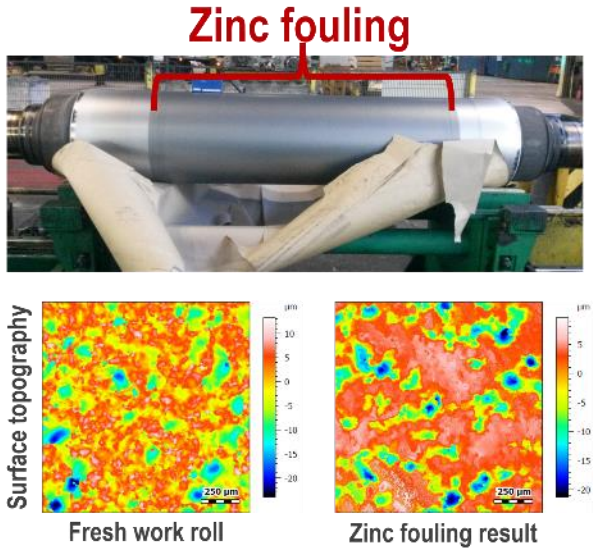
INTRODUCTION

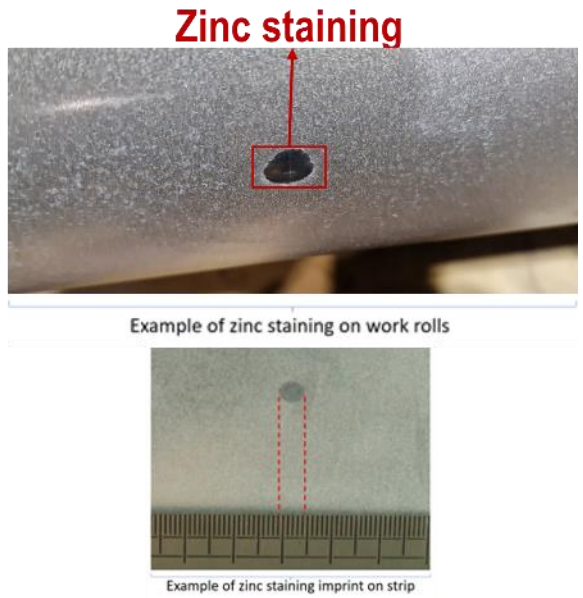
Source : AHSS Guidelines – Hot dip galvanizing, AHSS Insights



- **Context:** Hot-dip galvanizing – Skin-pass mill
- **Challenges:** Zinc fouling and staining during skin-pass rolling lead to quality control rejects
- **Current Solution:** High-volume water and detergent washing systems

INTRODUCTION





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INTRODUCTION

30.000m³/year of water
400k€/year

40m³/year of detergent
80k€/year

18 kW continuously for high pressure water jets
Cost not Specified **(> 110MWh**/year)

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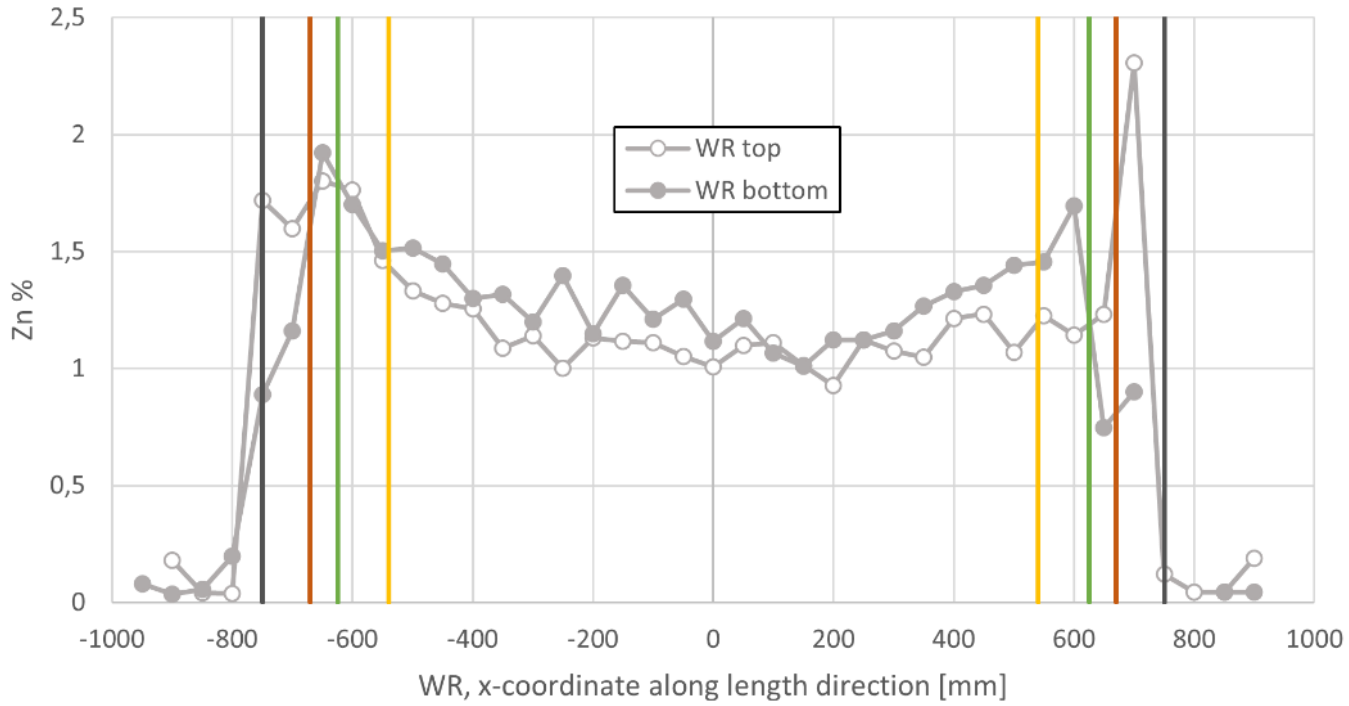
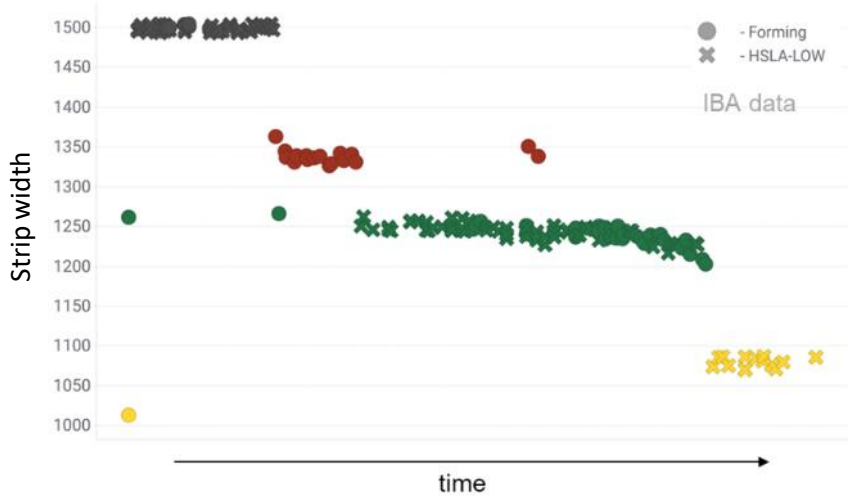
CHARACTERISATION OF WORK ROLLS CONTAMINATION

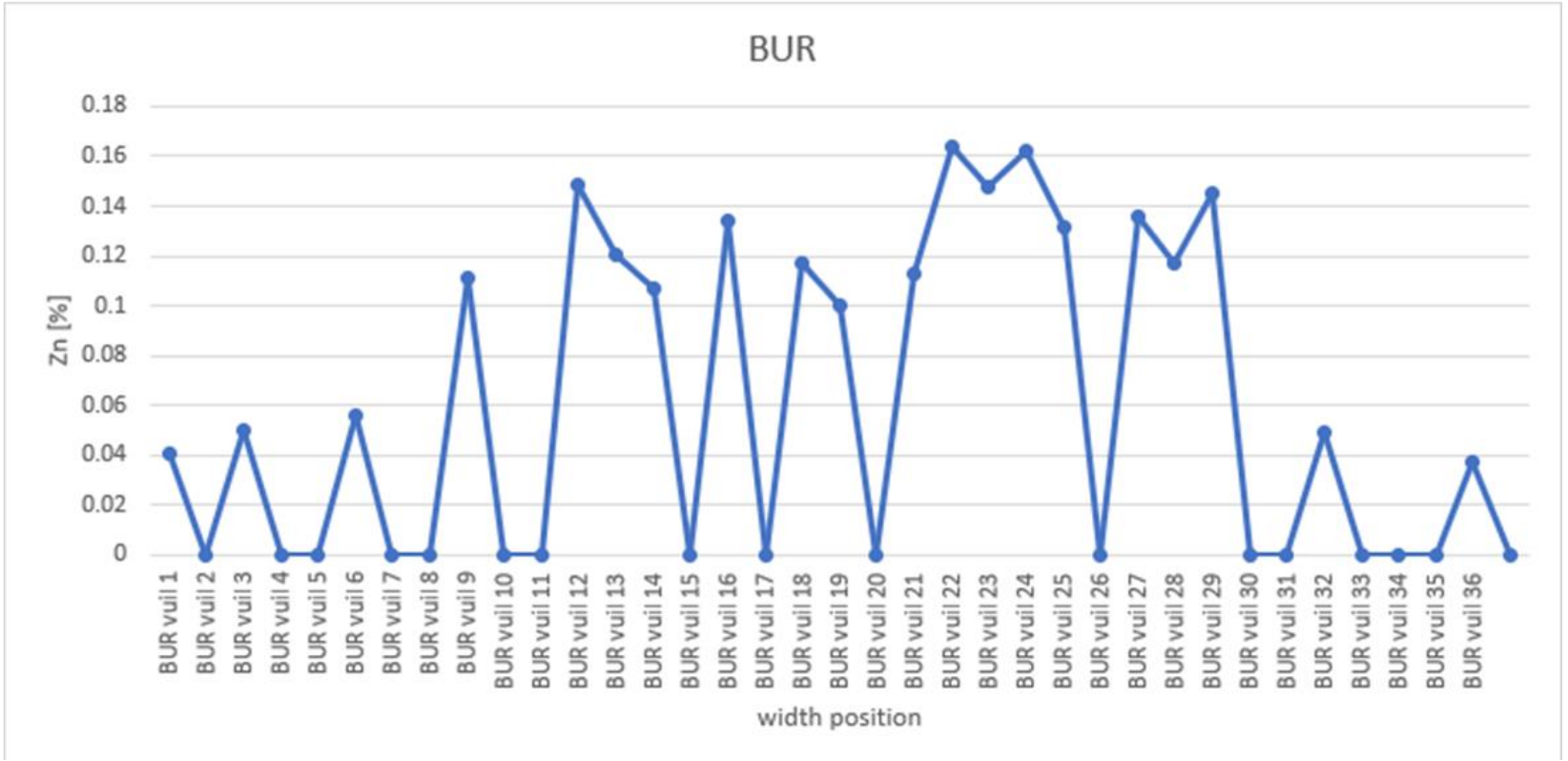
Zn fouling distribution across WR length





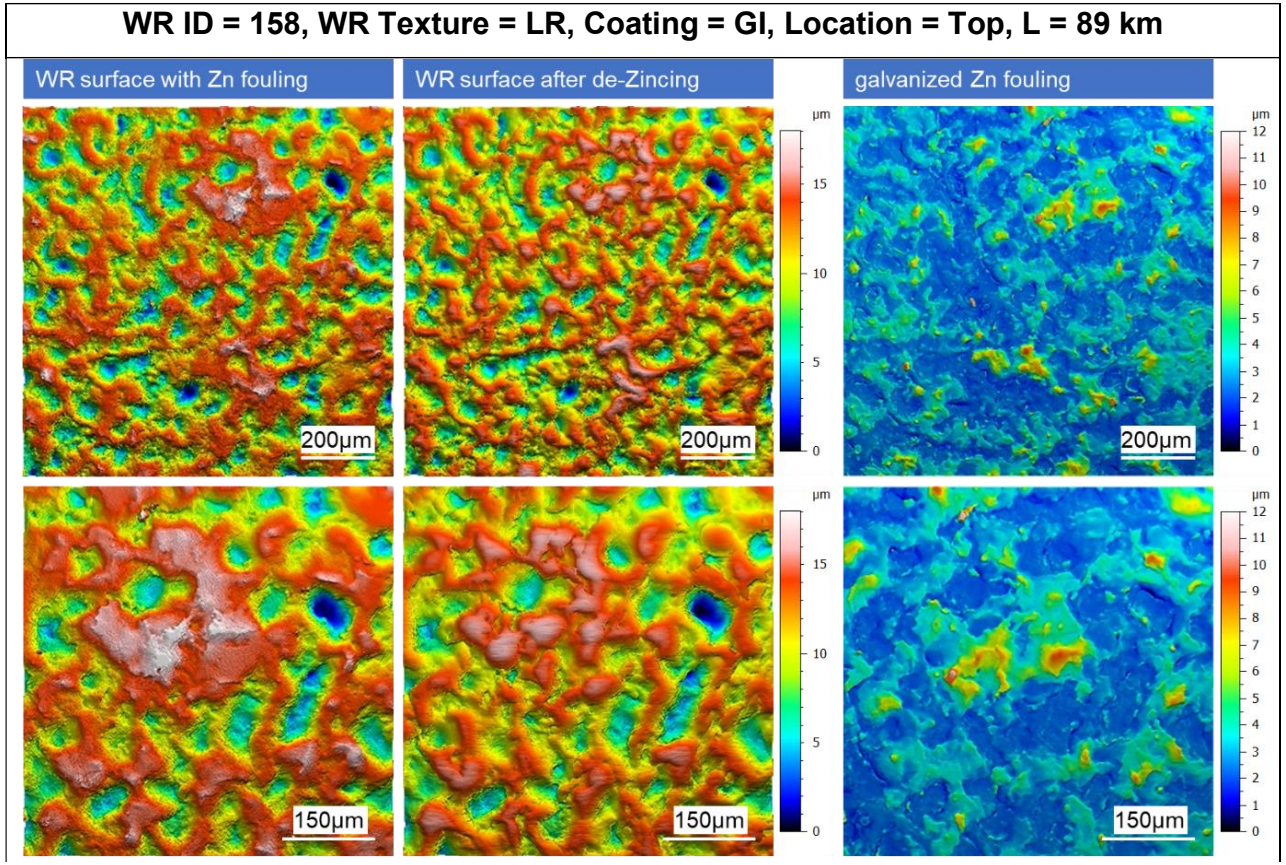
CHARACTERISATION OF WORK ROLLS CONTAMINATION

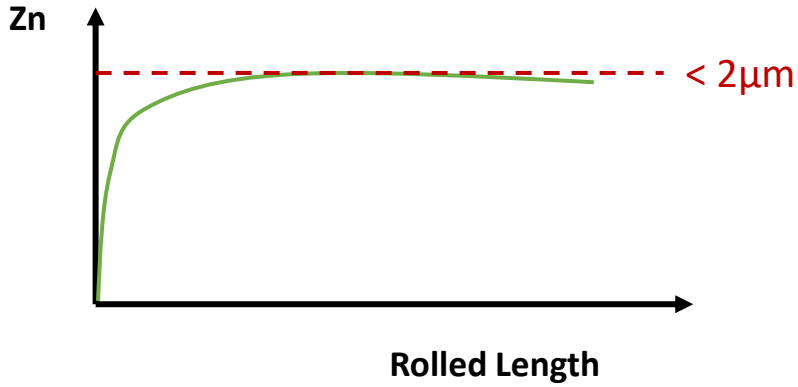
Zn fouling distribution across BUR length



CHARACTERISATION OF WORK ROLLS CONTAMINATION

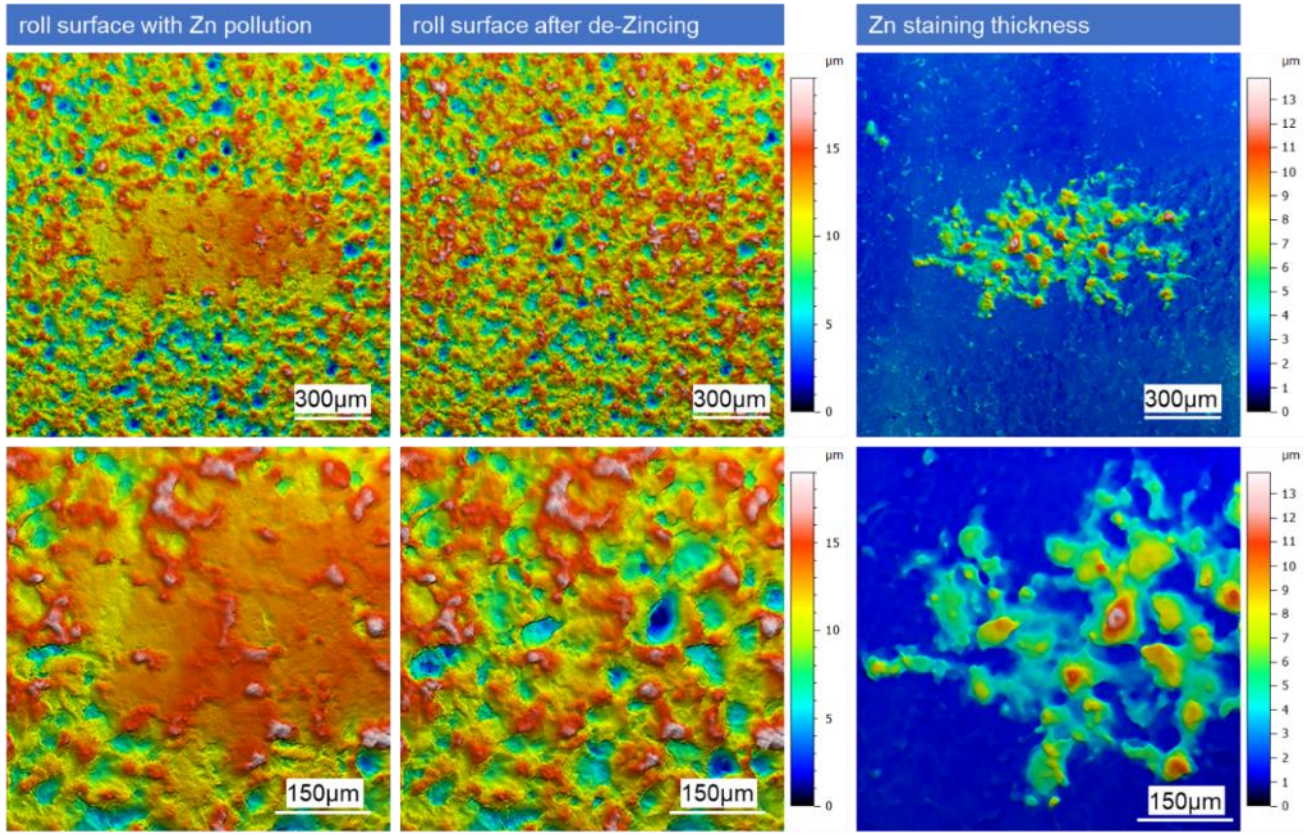
Zn fouling morphology & distribution over the coil length

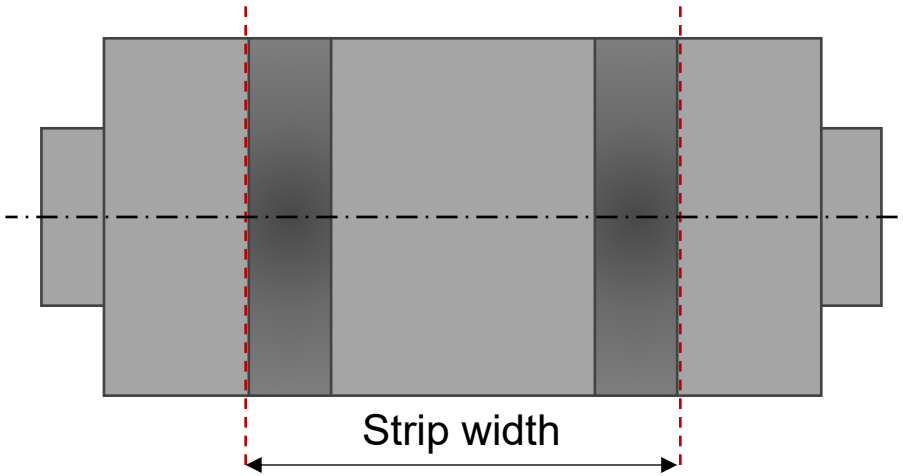




CHARACTERISATION OF WORK ROLLS CONTAMINATION

Zn staining morphology & distribution over the WR length





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EFFECT OF PROCESS PARAMETERS ON ZINC FOULING

Rolling Force

Rolling Length

Slip

Speed

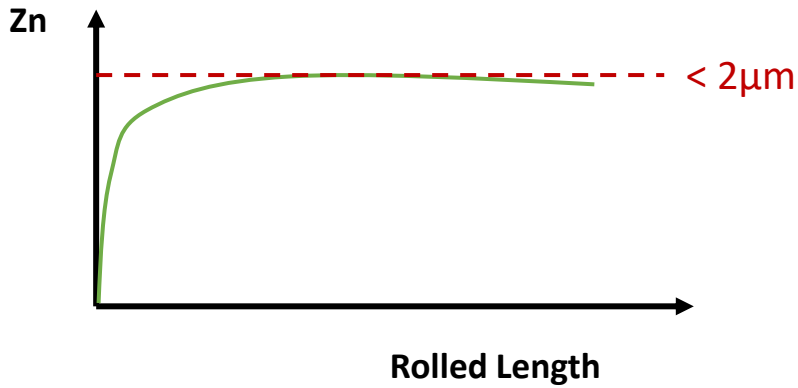
Cr-plating of WRs

Detergent usage

➔ Zinc fouling higher on **Low Roughness** work rolls

➔ Zinc fouling reaches a stable value after **a few rolling meters (< 100m)**

No clear connection between most process parameters except **rolling length**



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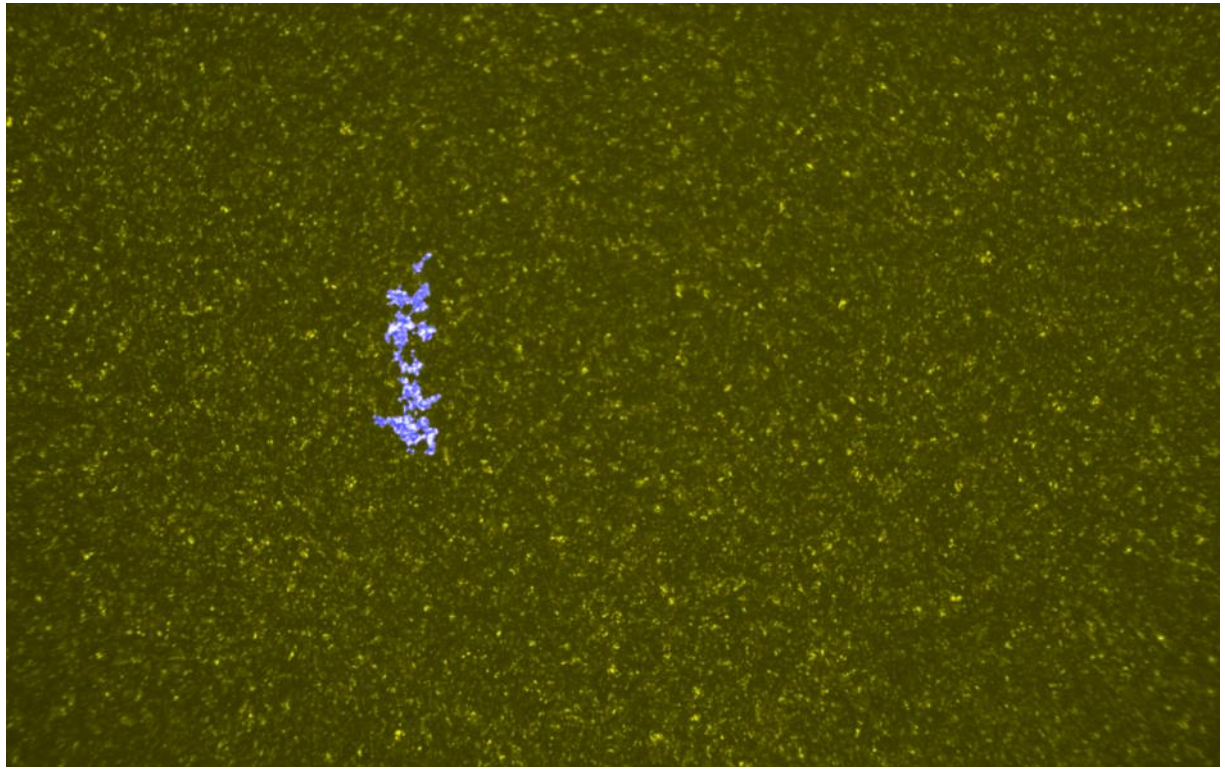
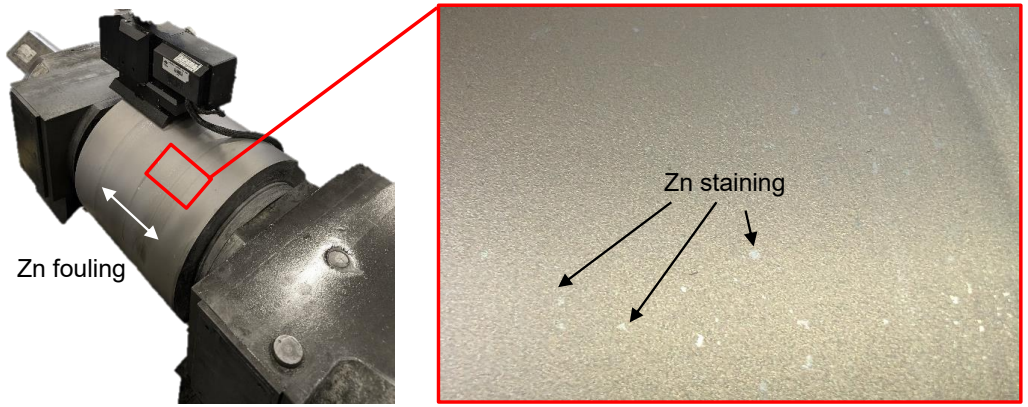
ON-LINE MEASUREMENT SYSTEM

Zn staining detection

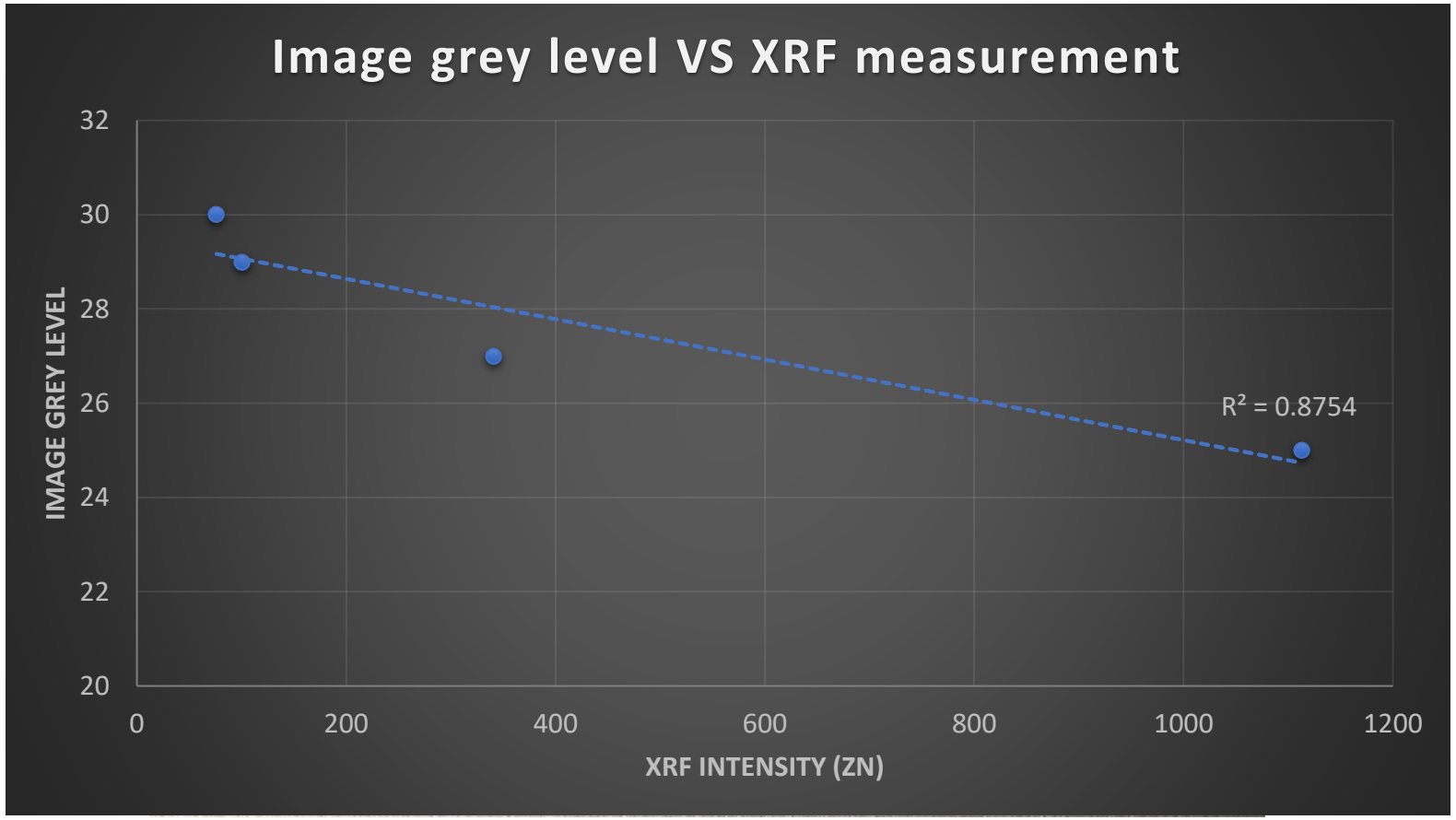


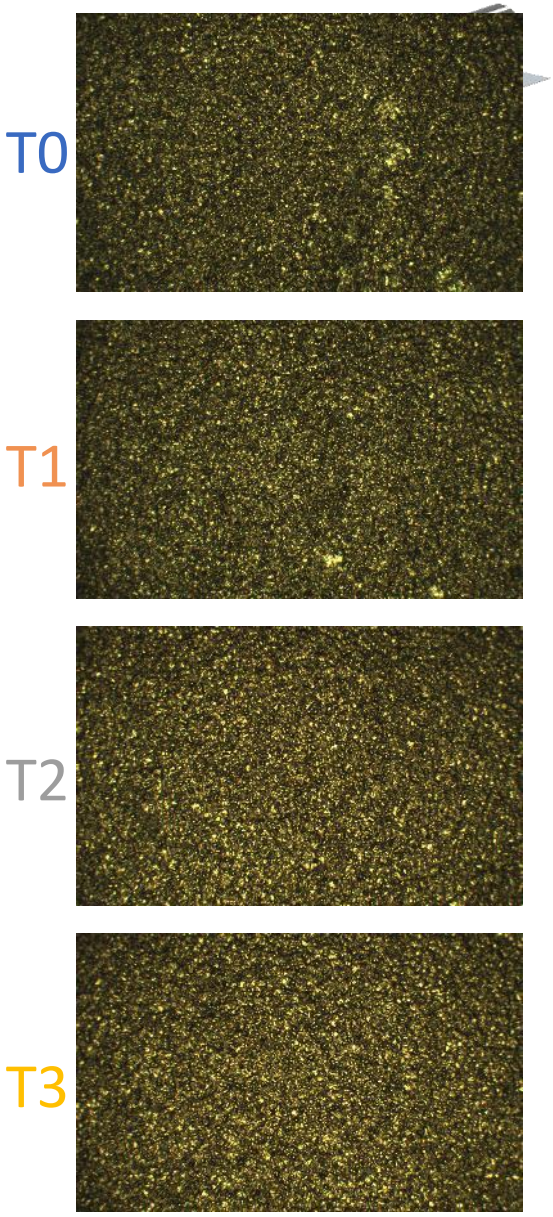
FOV: 7600µm (3,93 µm/pixel)



ON-LINE MEASUREMENT SYSTEM

Zn fouling quantification





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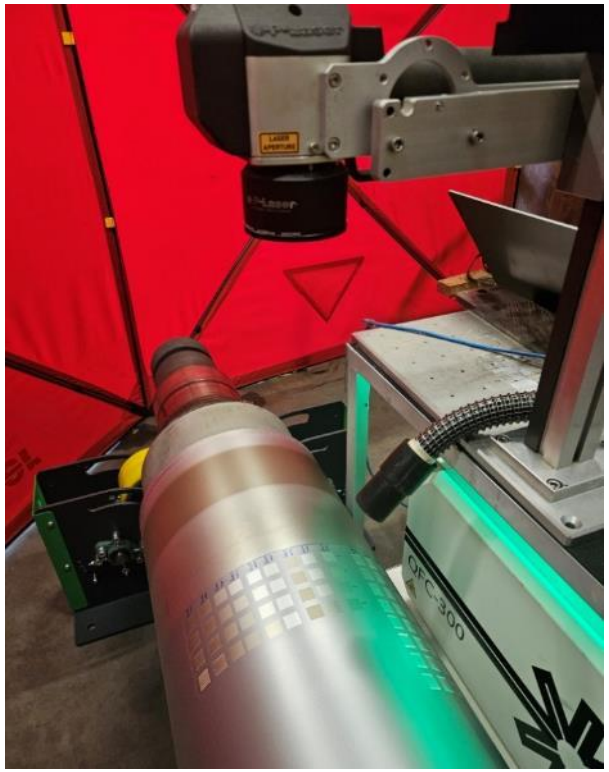
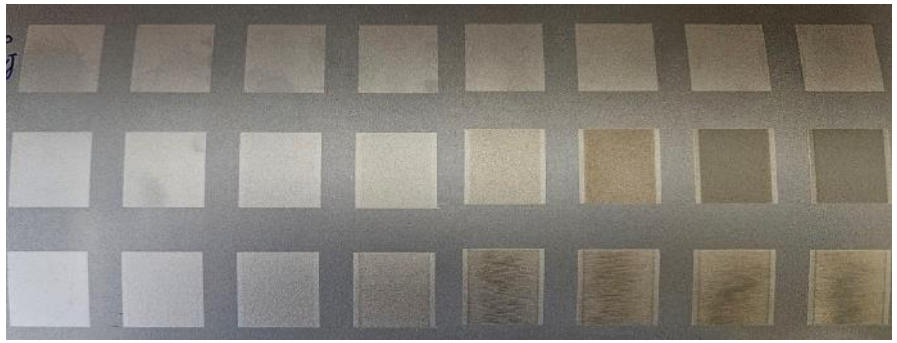
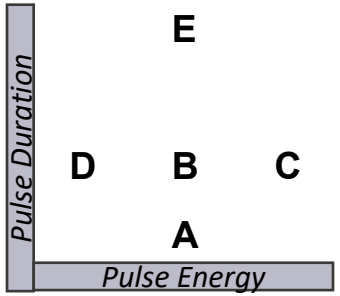
LASER CLEANING OF WORK ROLLS

Zinc removal performance – XRF results



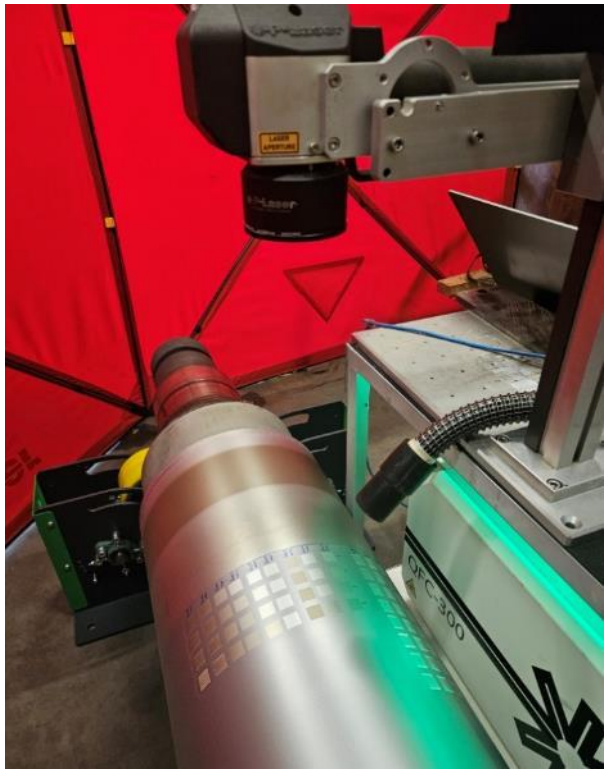




Setting	Passes = 0	1	2	3	5	20
Setting **A**	0.775	0	0	0	N.A.	N.A.
Setting **B**	0.775	0.029	0.021	0	N.A.	N.A.
Setting **C**	0.775	0	0	0	N.A.	N.A.
Setting **D**	0.775	0.233	0.088	0	0	0
Setting **E**	0.775	0.032	0.025	0	0	0

LASER CLEANING OF WORK ROLLS

Dynamic laser cleaning of zinc fouling



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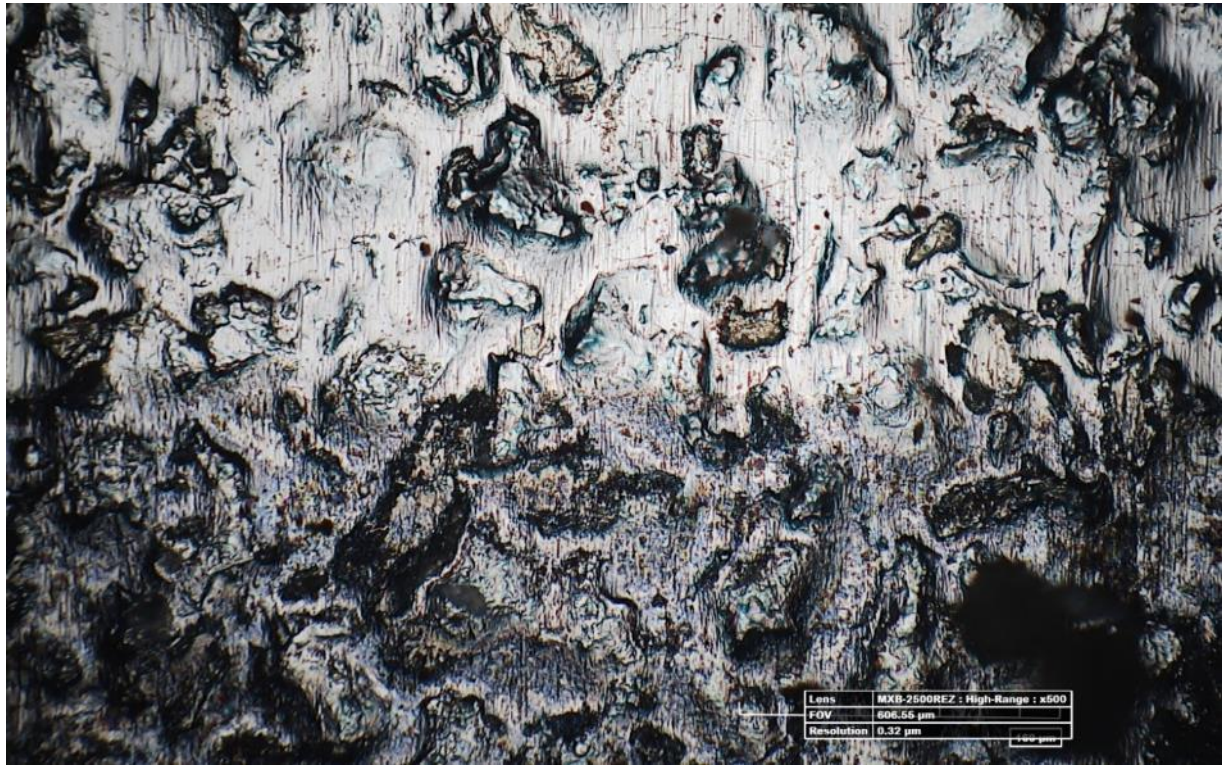
OPTICAL MICROSCOPY & ROUGHNESS MEASUREMENTS

Quantify optimal laser settings for zinc removal without damaging roll structure



Microscope image of Setting D cleaned with 20 passes (top side is cleaned, bottom is untreated)

Number of Passes	Ra (µm)	Rz (µm)
1	1.414	8.372
2	1.304	8.011
3	1.386	8.542
5	1.253	7.162
8	1.326	8.049
12	1.310	7.585
16	1.359	8.174
20	1.241	7.681

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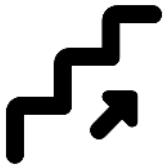
CONCLUSION & NEXT STEPS

CRM GROUP

✓Industrial and pilot trials provided valuable insights into zinc fouling and its evolution

✓Laser cleaning can remove the zinc while preserving work roll texture

✓On-line inspection system can detect appearing zinc staining



➢Further investigate the quantification of zinc fouling using the on-line inspection system

➢Finalize the integration of the system and validate its performance under rolling conditions

➢Optimize laser cleaning algorithm on a moving target

➢Set up a rotation bench to synchronize all equipment at operational rolling speeds

THANK YOU

www.crmgroup.be

Grateful acknowledgements to the EU commission for funding (Grant 101156458)

Co-funded by the European Union

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For a better future