



**Elizaveta LAPUSHKINA**  
Thèse Post-doc, 2016 – 2019  
MATEIS (Éric Maire), France  
FRI (Kazuhiro Ogawa), Japan  
ElyTMax (Kazuhiro Ogawa, Gael Sebald)

# Development of anti-corrosion coatings elaborated by cold spray - microstructure and performance relationship

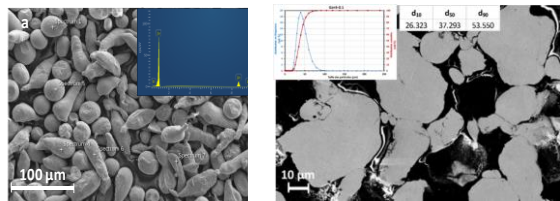
## Context

### Zn powder (99,9% purity):

- $T_m = 420 \text{ }^\circ\text{C}$
- Density =  $7.14 \text{ g/cm}^3$
- Young's modulus =  $108 \text{ GPa}$
- Brinell hardness =  $370 \text{ MPa}$
- Tensile strength =  $37 \text{ MPa}$

### Objectives:

- Elaboration of Zn sacrificial coatings with designed microstructure by cold spray.
- Optimization of the coating process



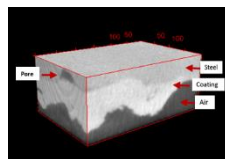
Pure Zinc powder well suitable for preparation of cold spray coatings for restoration of large objects and anti corrosion application

## Method and tools

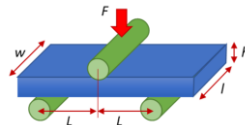
High pressure cold spray method

Temperature  $< 800 \text{ }^\circ\text{C}$   
Pressure  $< 5 \text{ MPa}$

Tomography



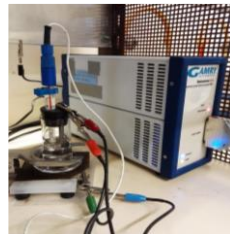
Bending test



Electrochemical measurements: 3 electrode cell

OCP, LSV

Micro electrochemical measurements



Other techniques:  
SEM, Optical microscopy, XRD, EDS, EBSD

## Results

### Optimization of spraying parameters:

- High adhesion
- High deposition efficiency
- sufficient thickness of the coatings at one pass of the spraying gun

### Doehlert uniform shell design:

- Preparation of 7 samples from Doehlert design matrix
- Microstructure and mechanical analyzing of coatings
- Prediction of corrosion properties of coatings according to spraying parameters
- Dependence of spraying parameters, microstructure and corrosion resistance of Zinc cold spray coatings

