



FUI NEPAL project is partly funded by the European Union (ERDF)  
 NEPAL project proposed for AAP FUI n°19

# NEPAL: NEW PROTECTIONS FOR ALUMINIUM

## CONTEXT OF THE STUDY

### INTRODUCTION

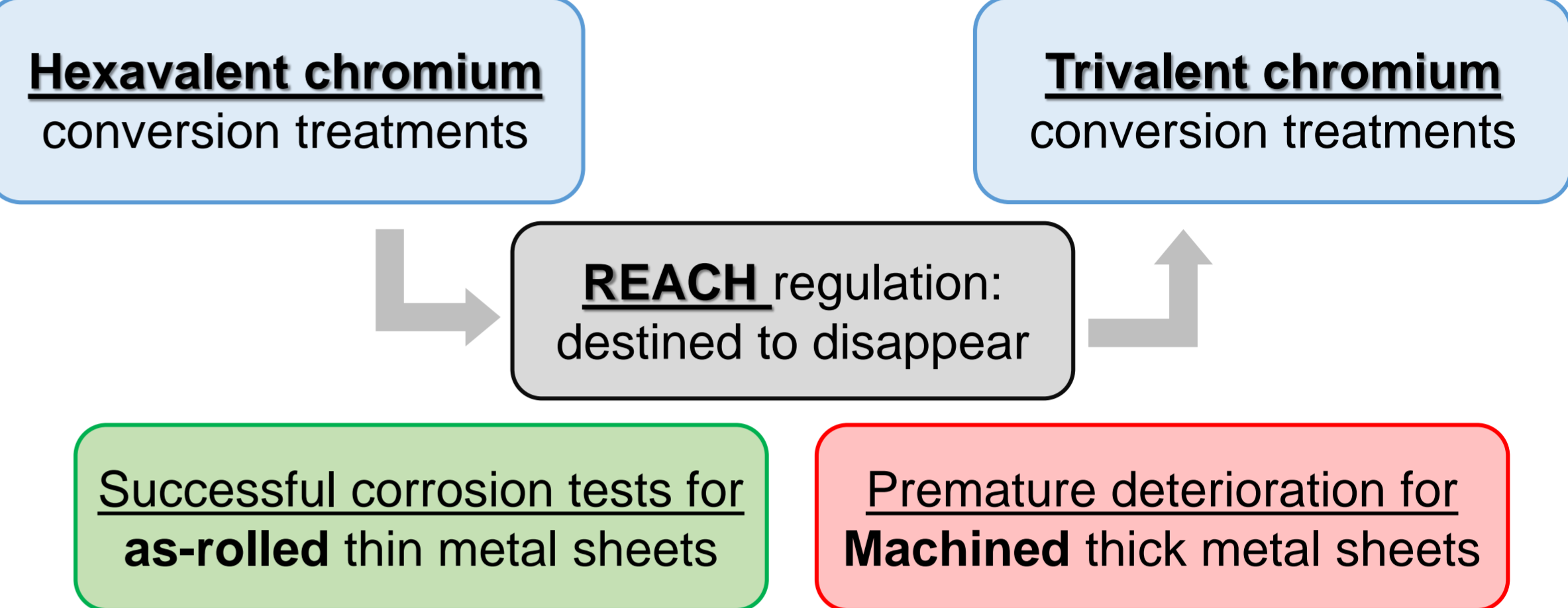
AA 2024 is often used for structural parts in aeronautics but it is susceptible to **corrosion**. Surface treatments, such as **hexavalent chromium** conversion treatment, are known to be efficient as corrosion protection.

### GLOBAL CONTEXT

The **hexavalent chromium** is harmful for the environment and the health and is destined to **disappear** in reply to the **REACH** regulation.

### INDUSTRIAL CONTEXT

First corrosion tests showed that a trivalent chromium conversion treatment was **efficient as corrosion protection** on an **as-rolled** thin metal sheet, whereas some **degradations** were observed on a thick machined sheet.



## PROJECT ISSUE

- To optimize conversion coatings previously developed and using **trivalent chromium** (APACA/ECOCONV projects) TRL 5 → 6
- To develop a new process without chromium TRL 3 → 4

## KEY DATES, FUNDINGS, PARTNERS AND TASKS

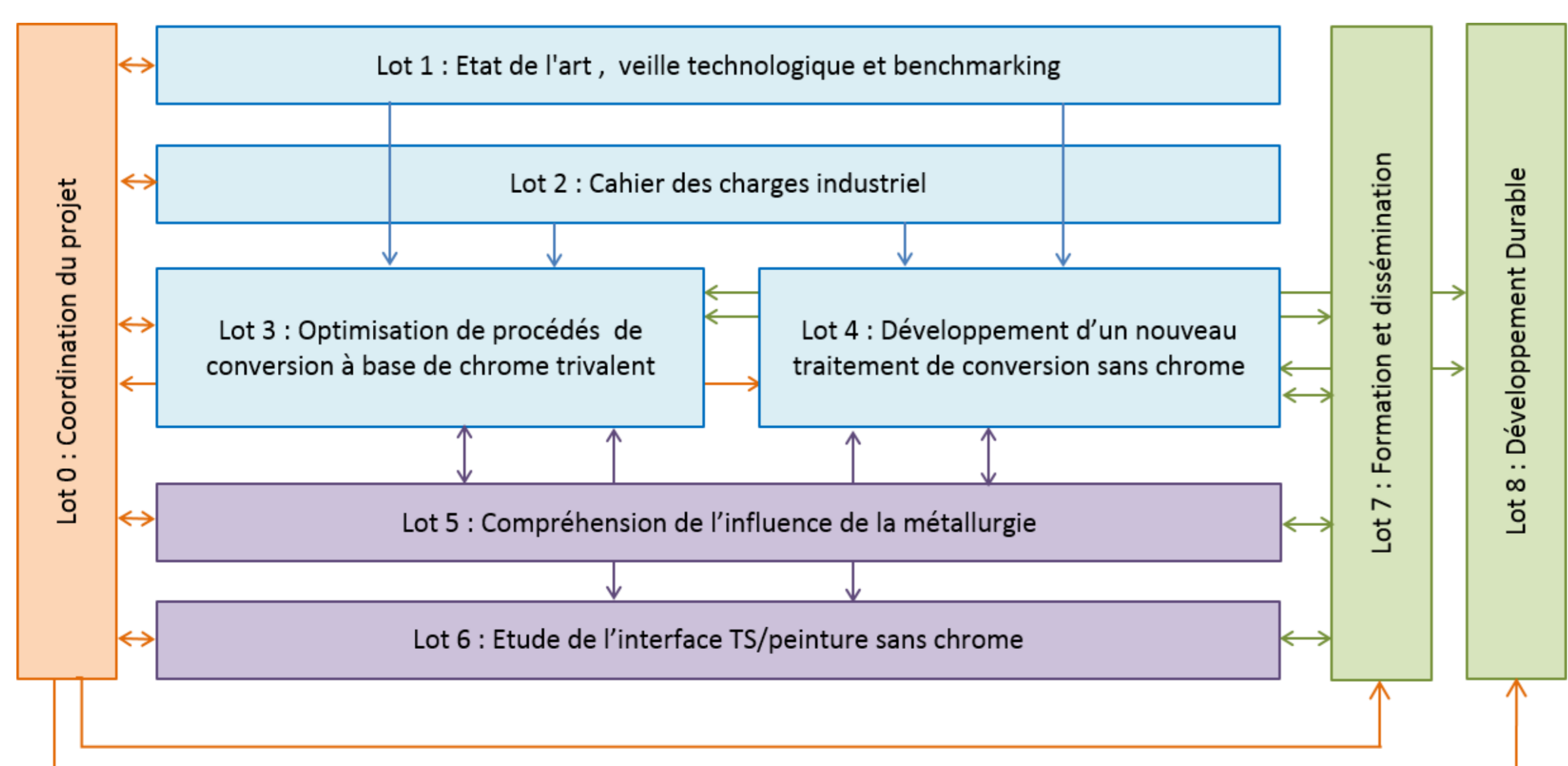
Project accepted on March 24<sup>th</sup> 2015 by BPI France and on November 16<sup>th</sup> 2015 by Région Occitanie for FEDER fundings  
 - beginning: october 1<sup>st</sup> 2015  
 - duration: 36 months (end of the technical part: september 30<sup>th</sup> 2018)  
 - End of the administrative part: september 30<sup>th</sup> 2019

Global budget: 4 143 326 € (Public fundings: 1 847 238 €)

Global cost for CIRIMAT INPT: 312 777,98 € (7,5% of the global budget)  
 Fundings: 75,64% of the global cost i.e. 100 % without taking into account the salary of the officials

Fundings	FEDER Région Occitanie	BPI France	Self-funding (INPT/CIRIMAT)
Amount	132 000 €	104 600 €	76177,98
% global budget	42,20	33,44	24,36

### NEPAL'S PARTNERS:



## CORROSION BEHAVIOR OF THE COATED MATERIAL

### Main issues for CIRIMAT/INPT

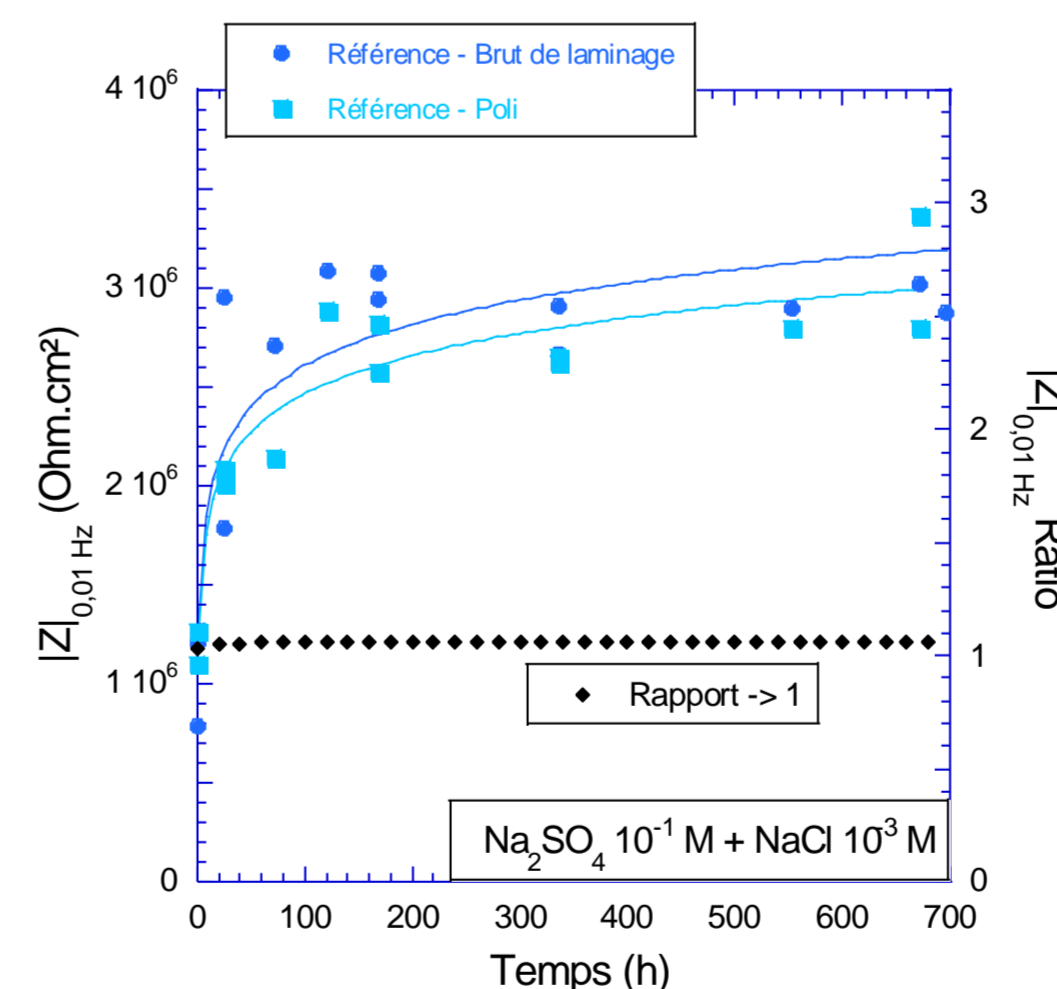
- (i) To identify a microstructure / corrosion behaviour relationship for the materials studied
- (ii) to evaluate the influence of the material microstructure on the corrosion resistance and fatigue properties of the materials coated with a trivalent chromium layer

### → Human resources:

Christine BLANC (leader for INPT), Bernard VIGUIER and Grégory ODEMER  
 1 PhD student: Romain SAILLARD

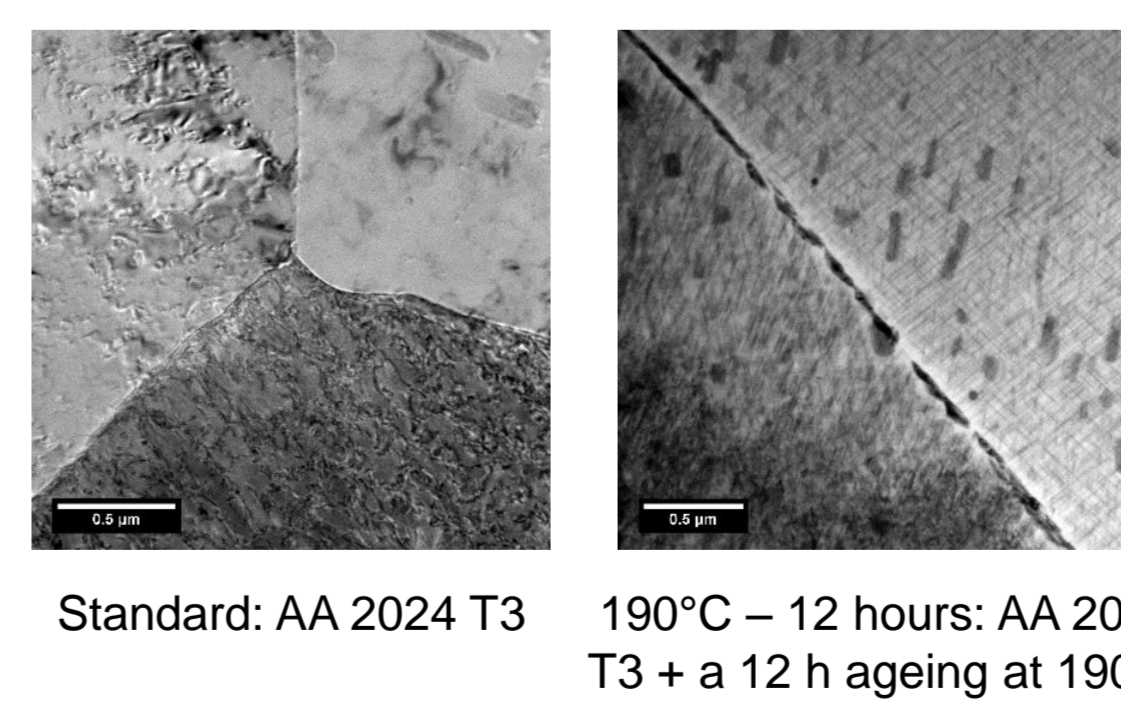
### Main results

- Influence of the surface state on the corrosion behaviour of the coated AA2024 T3

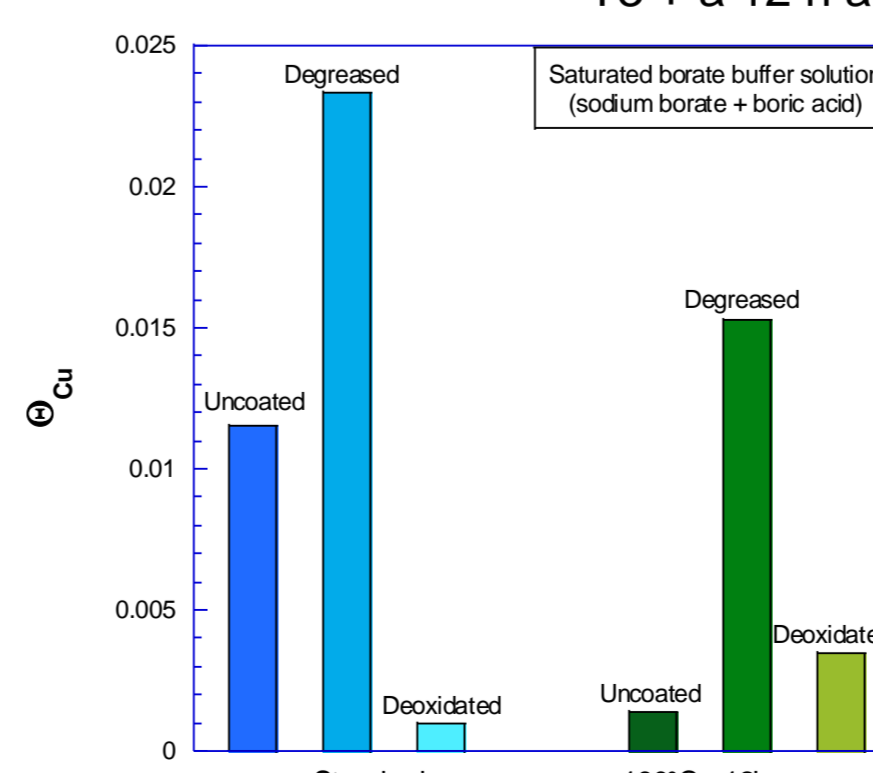


No significant influence of the surface state before the conversion process

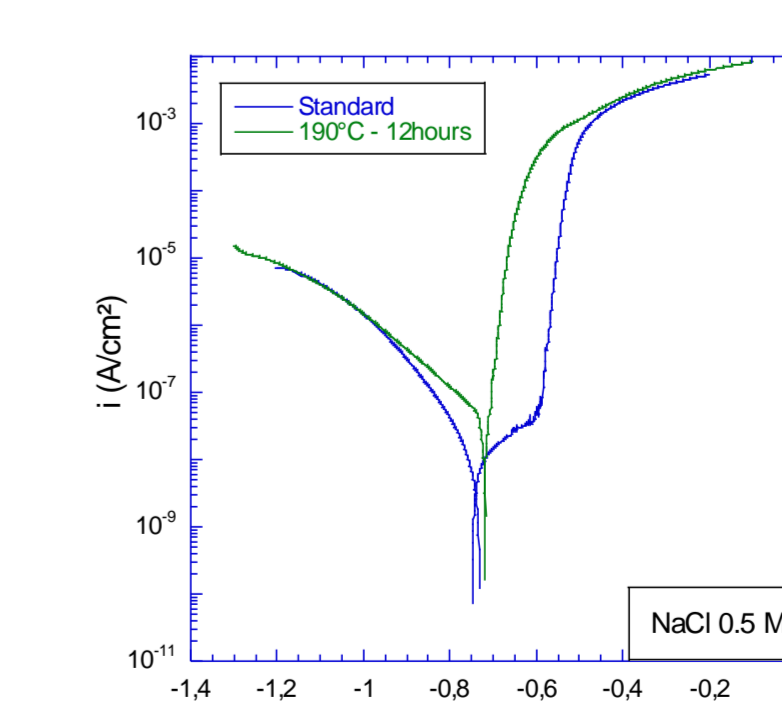
- Analysis of the coated layer formed on AA2024 depending on the microstructure



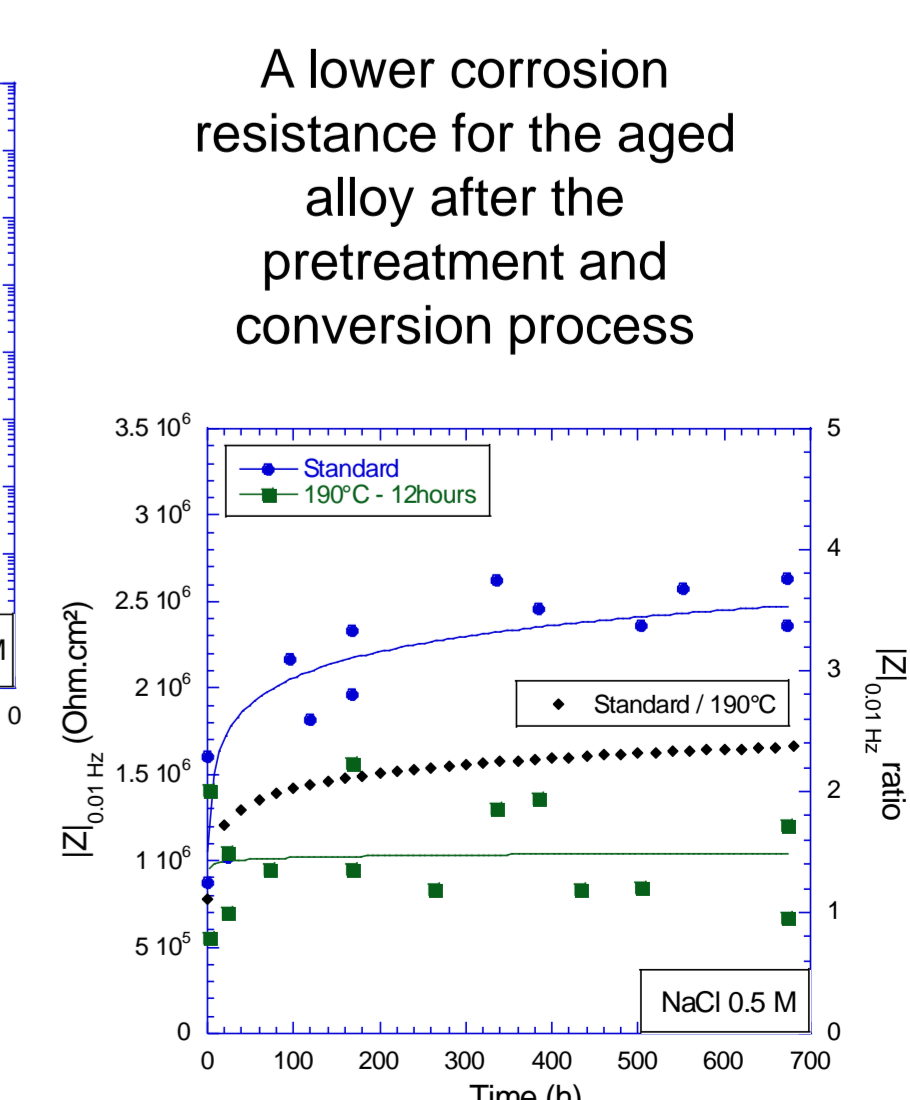
Standard: AA 2024 T3      190°C – 12 hours: AA 2024 T3 + a 12 h ageing at 190°C



More copper on the surface after pre-treatments for the aged alloy



After the conversion



A lower corrosion resistance for the aged alloy after the pretreatment and conversion process

Conclusions: Strong influence of the alloy microstructure, in particular of the copper amount and precipitation state of this element