ZCO-75: "Nature of Galvanizing Wettability on Advanced High Strength Steels"

Research proposal

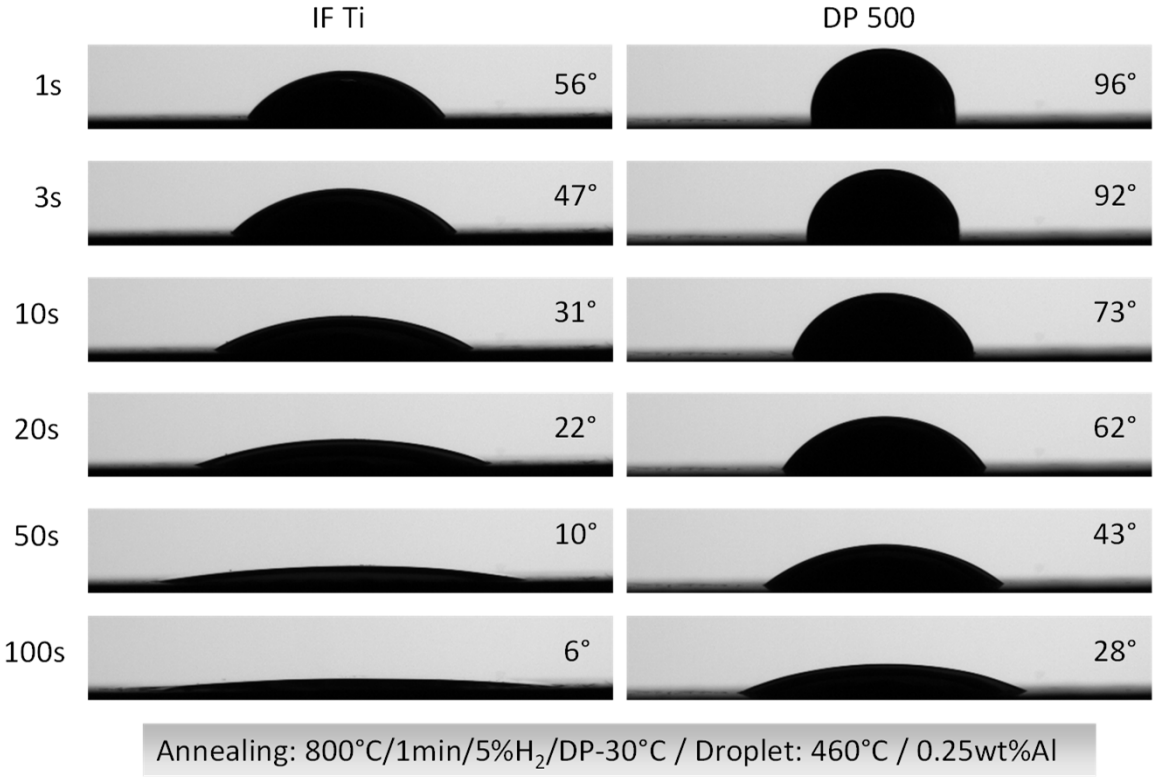
Galvanized Autobody Partnership (GAP)

Available Project Budget & Project Duration: $60,000 per year for a 3-Year Period

Research Leader: D. Debrabandere
Project Associate: L. Bordignon

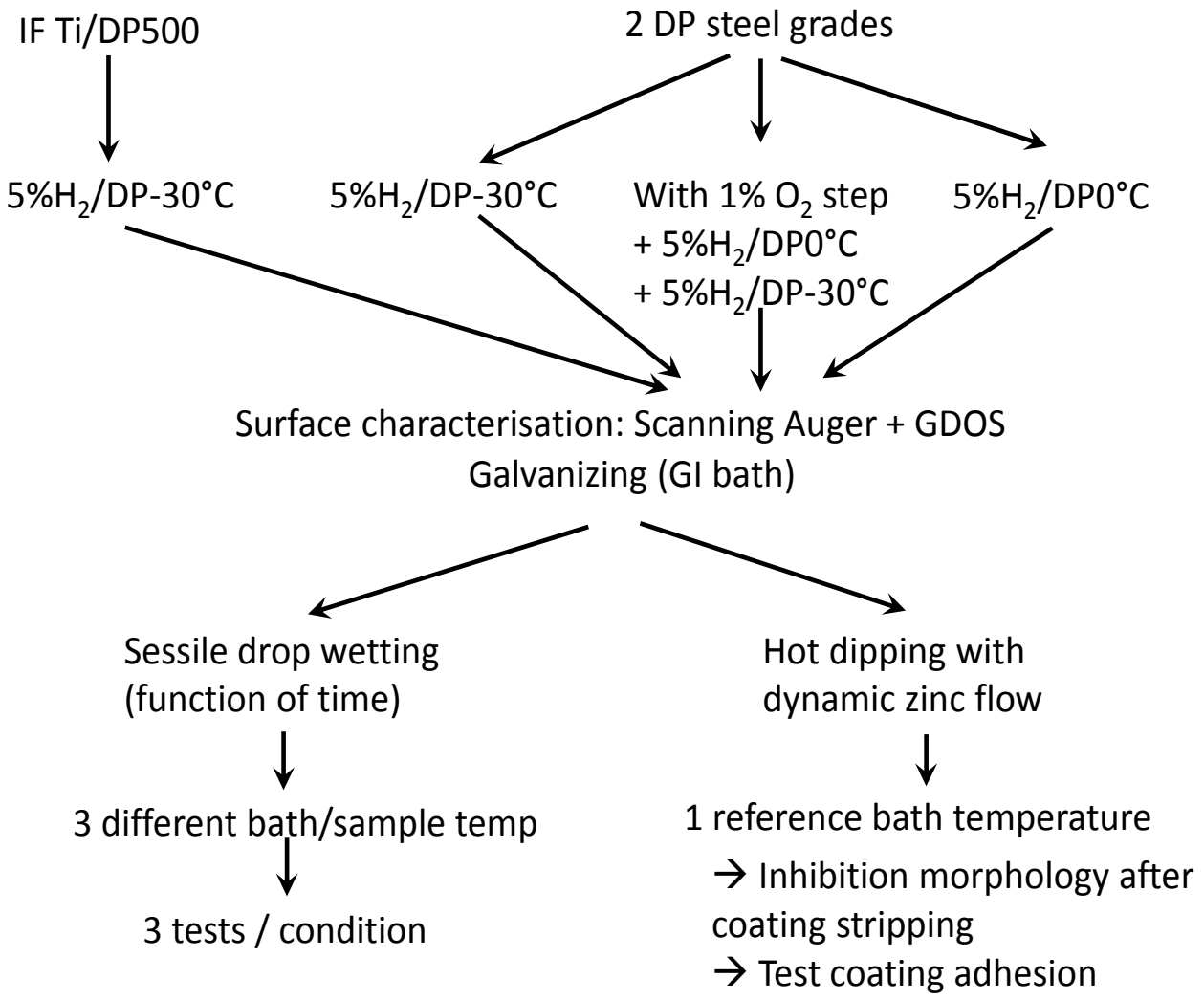
Objective:
Determine the best annealing conditions for galvanizing DP steel grades

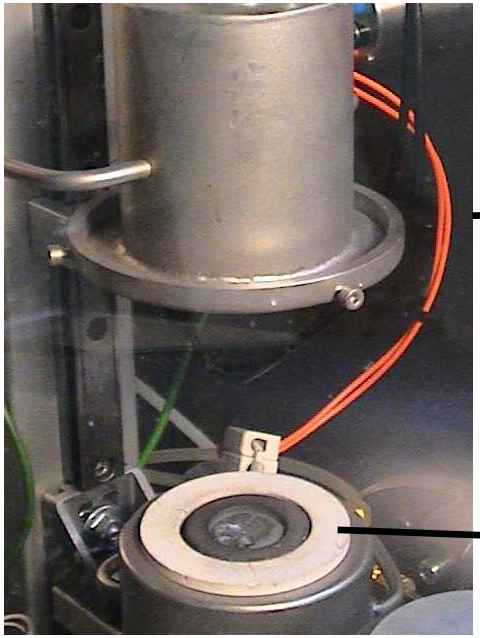
Steel composition:
- 2 high strength dual phase steels
- 2 reference steel grades (IF Ti and DP500)

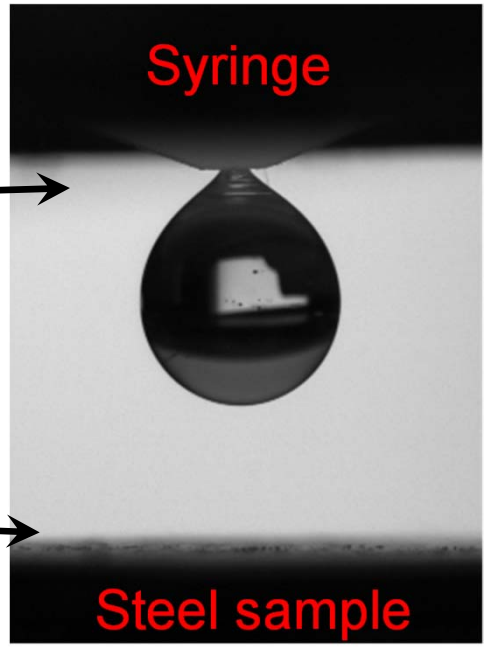


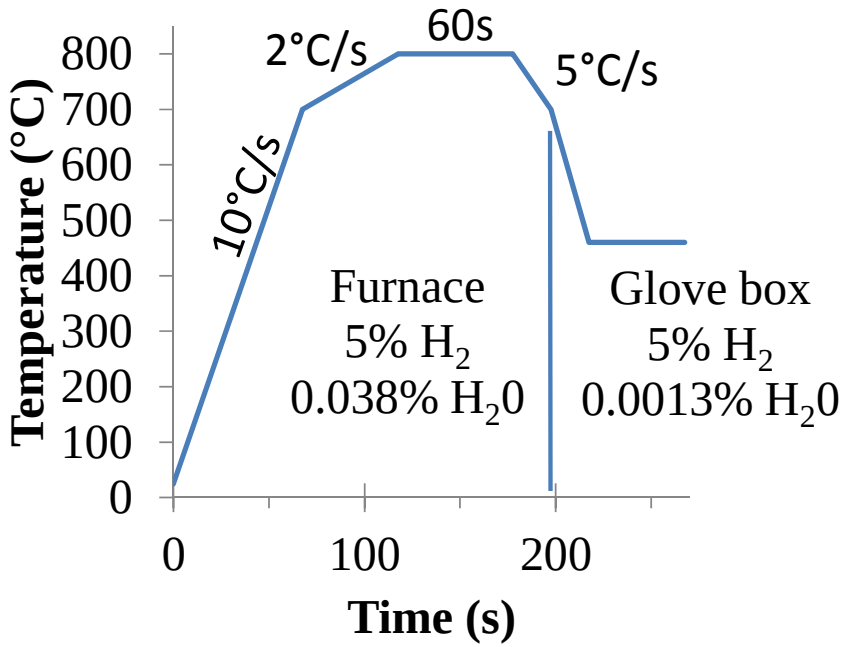
After 3s of contact, the wetting angle of the zinc droplet should be in range between 45° and 90° to guarantee a sufficient reactivity during dipping.

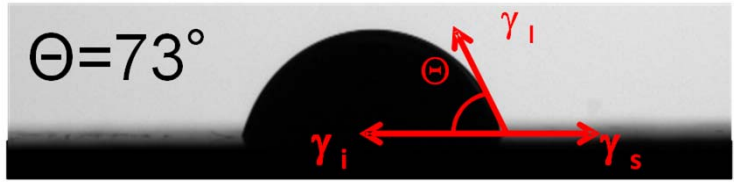
Work program

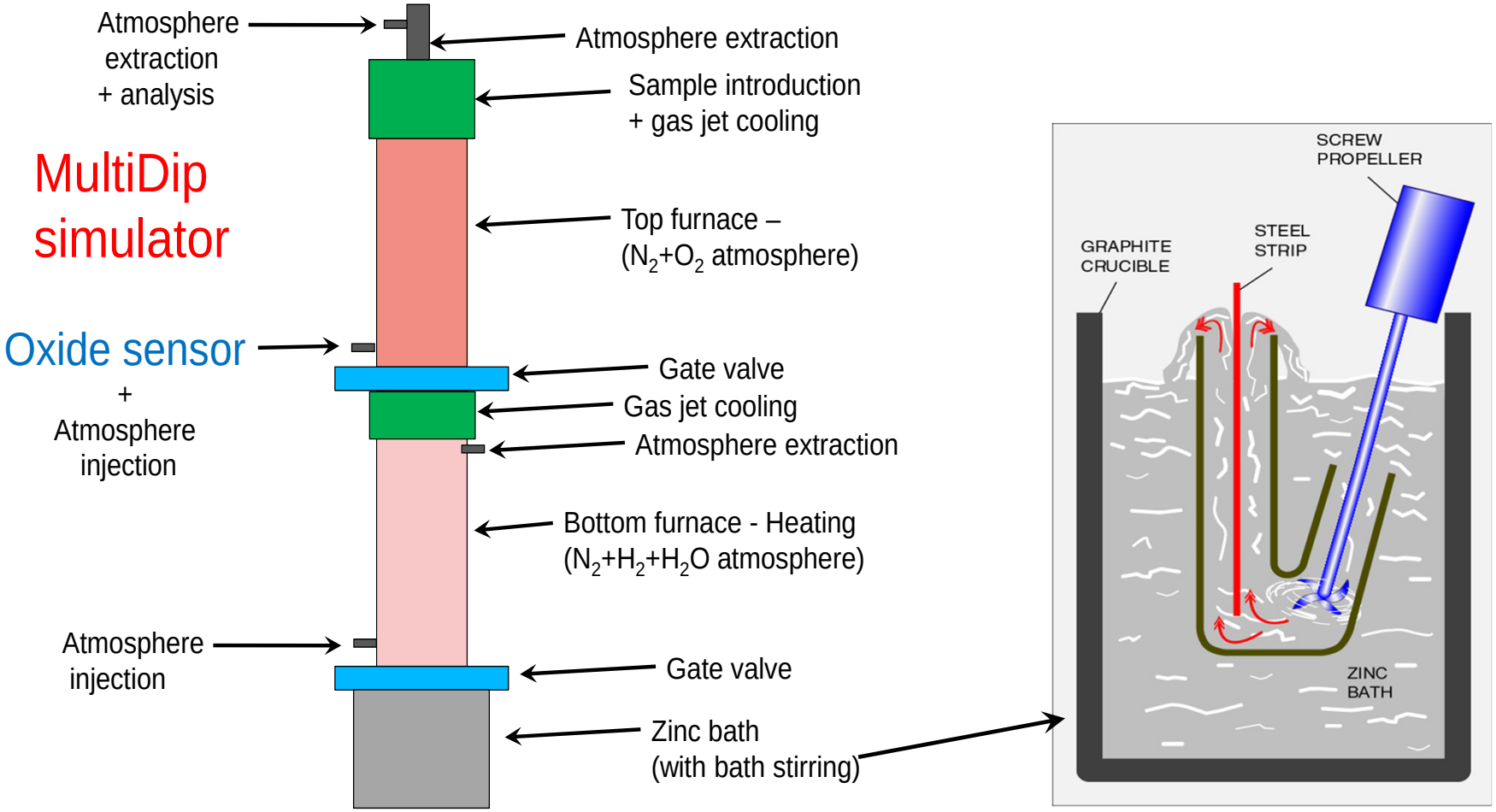





Syringe
Steel sample


Temperature (°C)
800
700
600
500
400
300
200
100
0
0
100
200
Time (s)
2°C/s
60s
5°C/s
10°C/s
Furnace
5% H2
0.038% H20
Glove box
5% H2
0.0013% H20

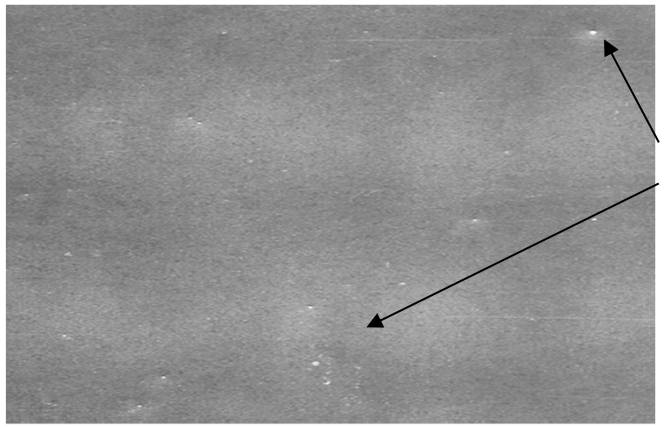

Θ=73°
γ l
Θ
γ i
γ s

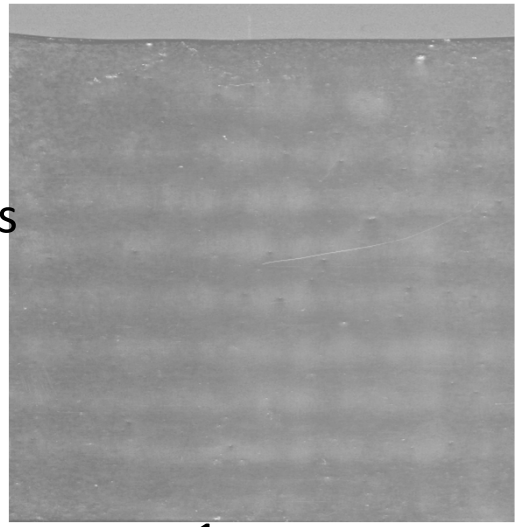


Schematic view of the MultiDip simulator allowing to perform an oxidation step in the top furnace during an annealing cycle made in the bottom furnace.

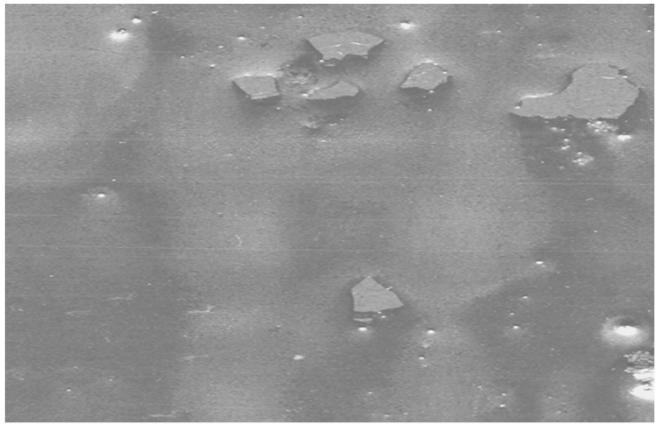
Steel : C - Mn (1%) - Cr (0.5%)
Annealing : 820°C-30s-15%H_2-DP-30°C
Hot dipping : Al = 0.23%, Fe = 0.007%, 3s, 460°C

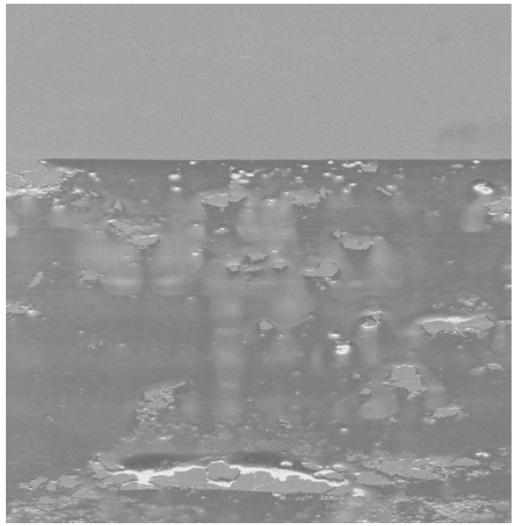
With Stirring





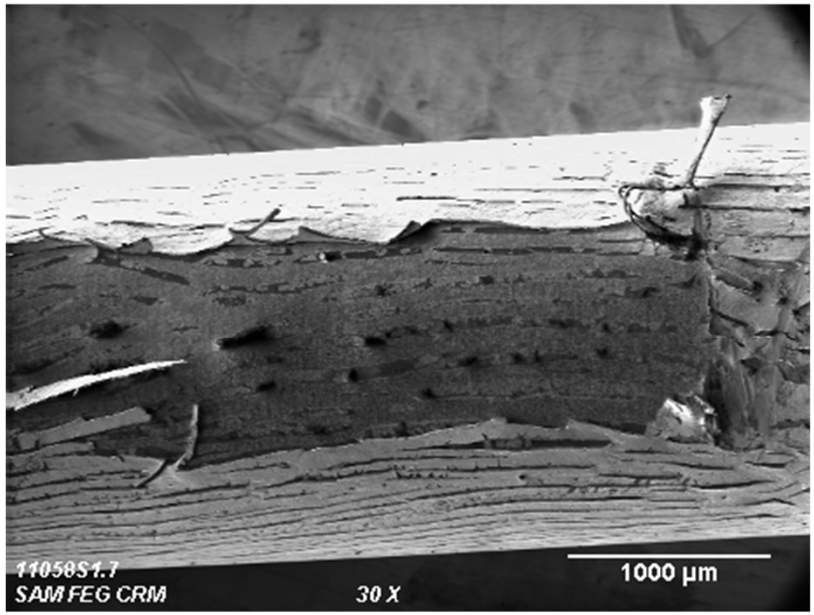
Without Stirring

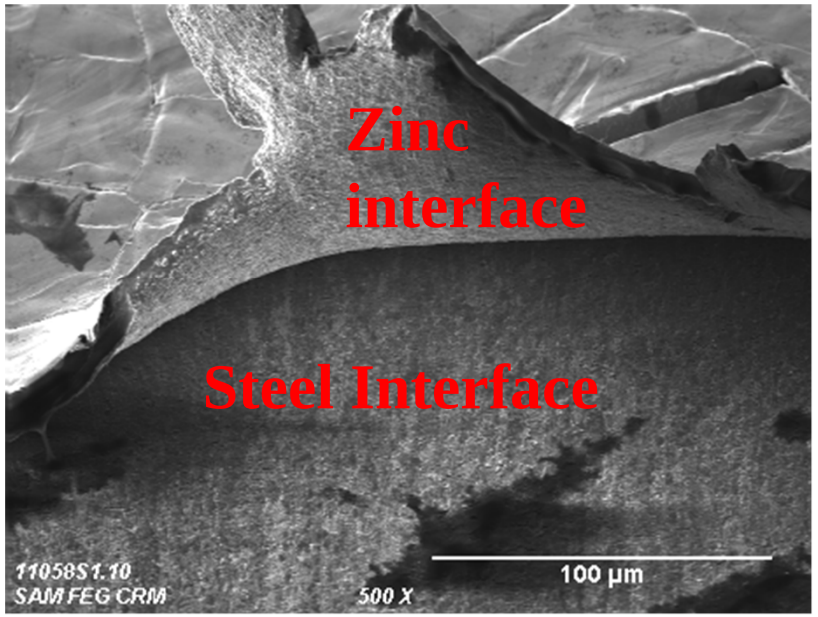




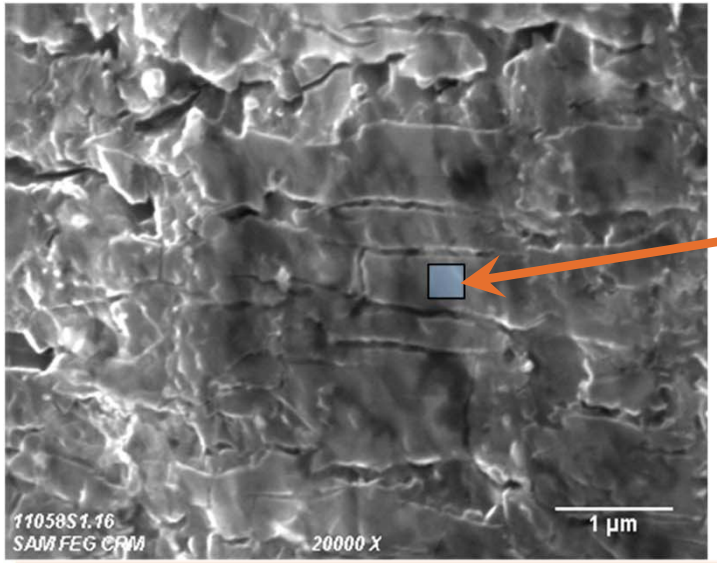
Influence of zinc stirring on coating wettability

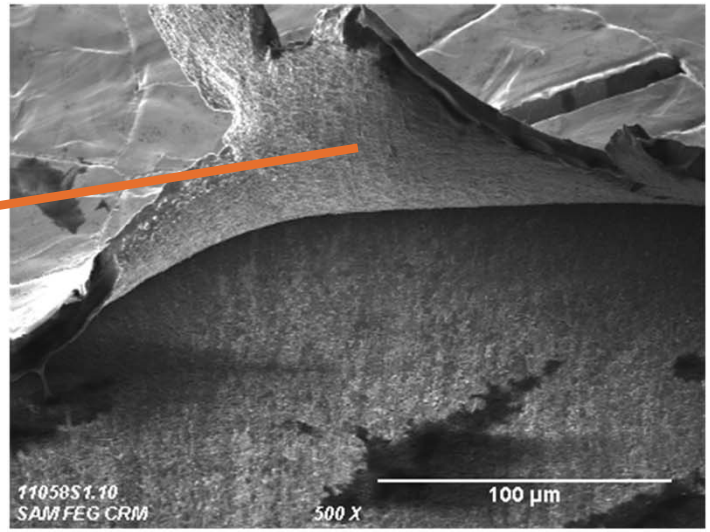
OT Bending + Tape

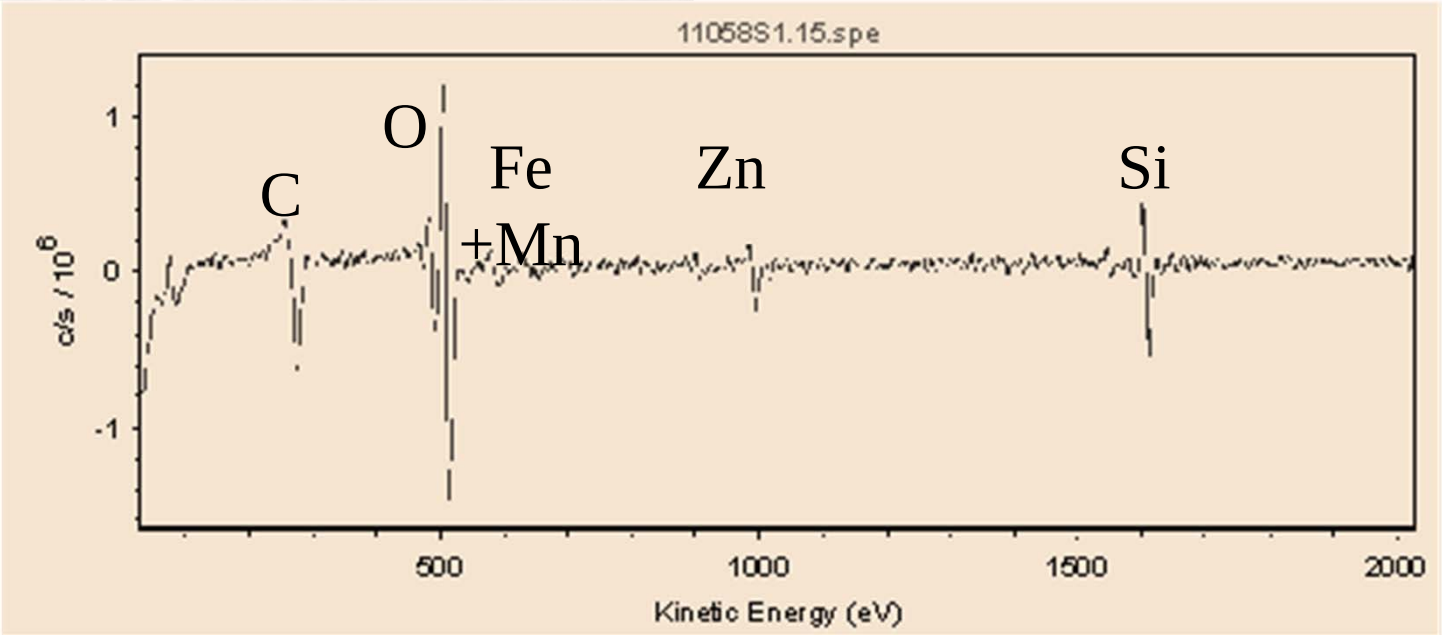


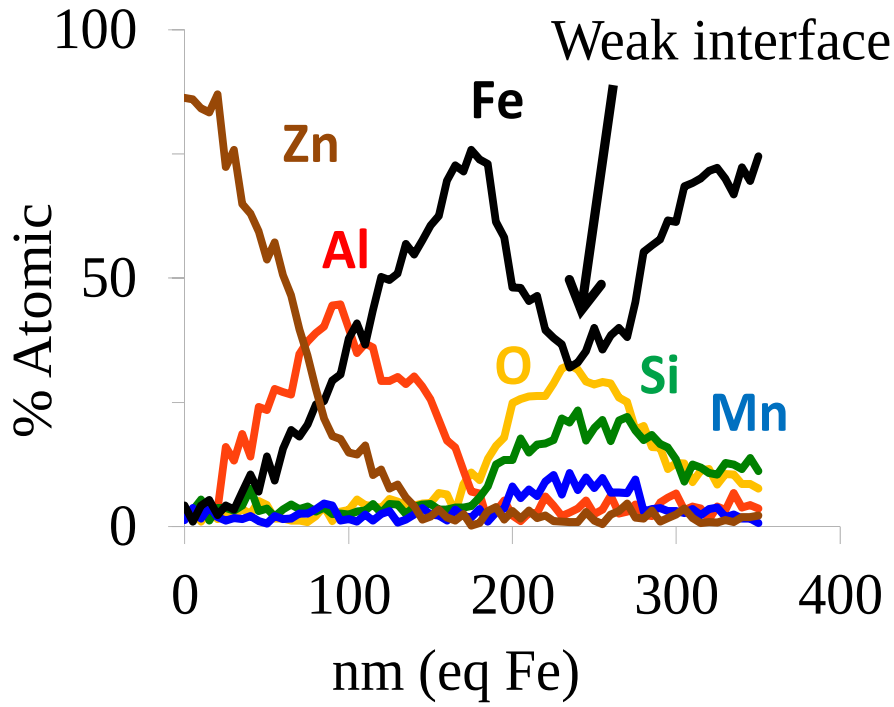


Interface / Zinc side









Scanning Auger analysis showing the presence of thin SiO_2 layer at the steel / coating interface after an oxidation/reduction process, which completely deteriorate coating adhesion (from ZCO-54 study)

Steels to be examined

- References: Ti-IF, DP500
- 2 other DP steels (same as ZCO-76?)

The project description

Description	1st Sem	2nd Sem	3rd Sem	4th Sem	5th Sem	6th Sem
1. Steel composition						
2. MultiDip trials						
2.1. Characterisation after the oxidation step						
2.2. Characterisation after full annealing						
2.3. Characterisation after hot dipping						
3. Wetting experiments						
4. Reporting and traveling						