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Characterization of Edge Protection Improved Cathodic Electrodeposition Coatings

Anıl Başçetin

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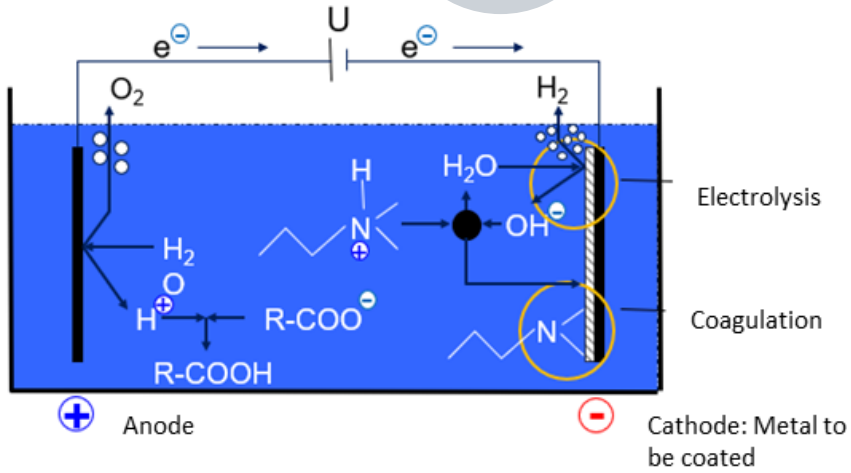
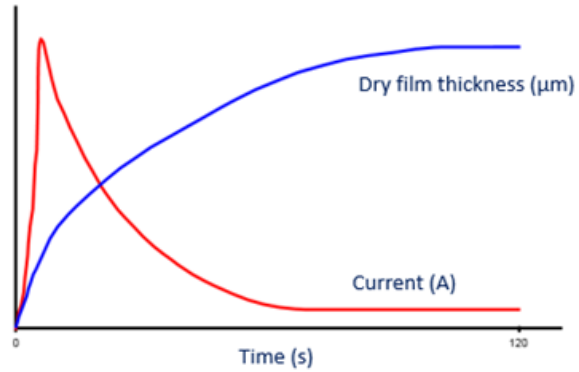
What is e-coat?

Electrophoretic paints are also known as electrocoat (e-coat)

E-coat is an organic paint which is dispersed in water and capable of carrying an electric charge

This allows the paint to deposit onto a metal surface with the opposite charge





Anode Reaction:

$2\ H_2O \longrightarrow 4\ H^+ + O_2 + 4\ e^-$

Cathode Reaction:

$2\ H_2O + 2\ e^- \longrightarrow H_2 + 2OH^-$

There are anodic and cathodic types

In cathodic electrodeposition (CED) the metal surface is negatively charged

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Why are edges important?

https://www.hydro.com/en/global/aluminium/industries/automotive/body-in-white/
https://velosdesignwerks.com/wheel-collection/crs-15-1-piece-monoblock/

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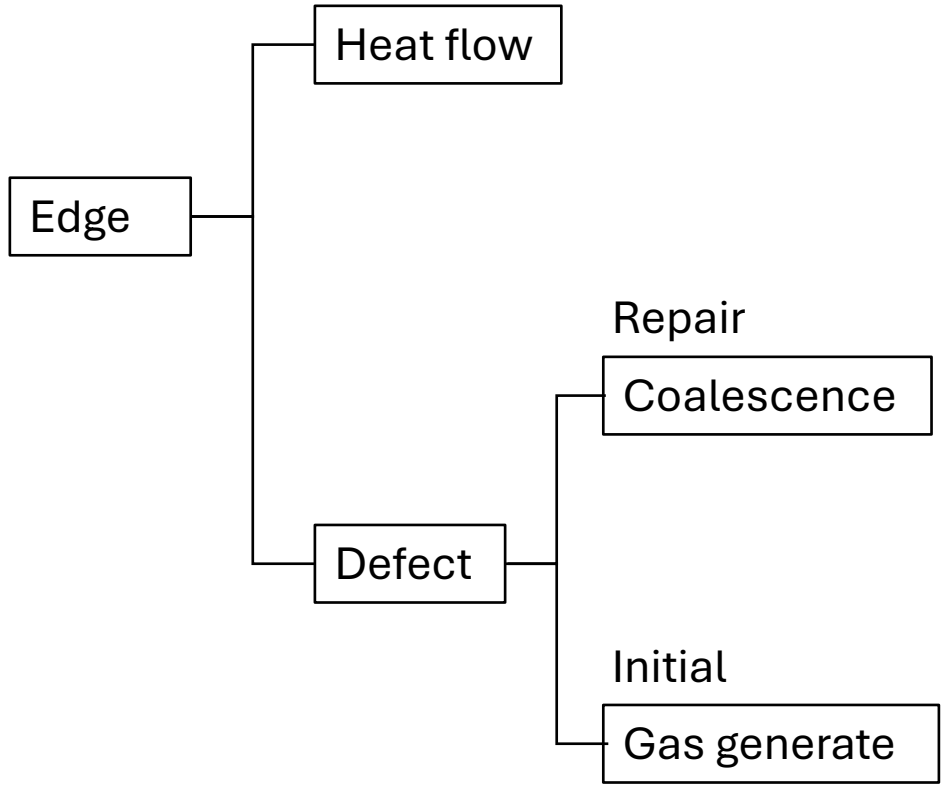
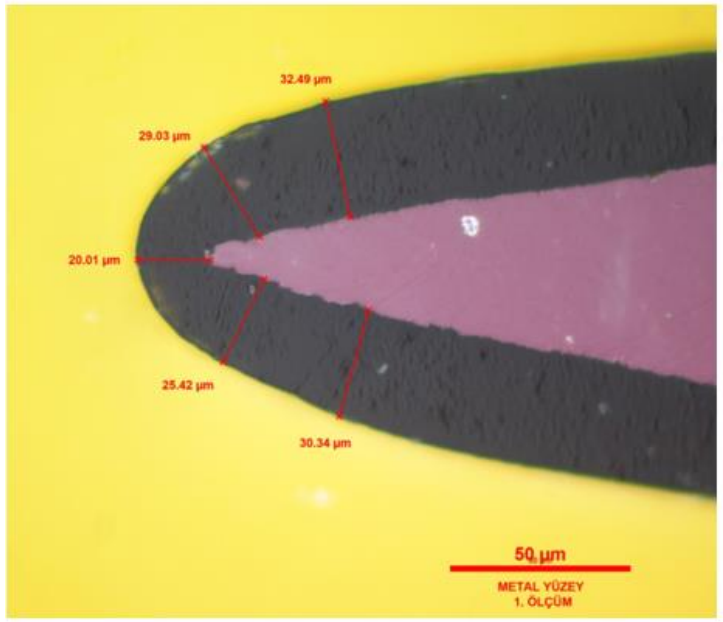
Why are edges important?

- Charges accumulate at sharp points, and this generates a stronger electric field close to the edge
- Initially thicker films are deposited at the edges
- When the repairability (coalescence) is insufficient, edge corrosion may fluctuate due to the effects of initial gas holes
- After bake, as a result of surface tension forces and film shrinkage the film flows away from the edges.

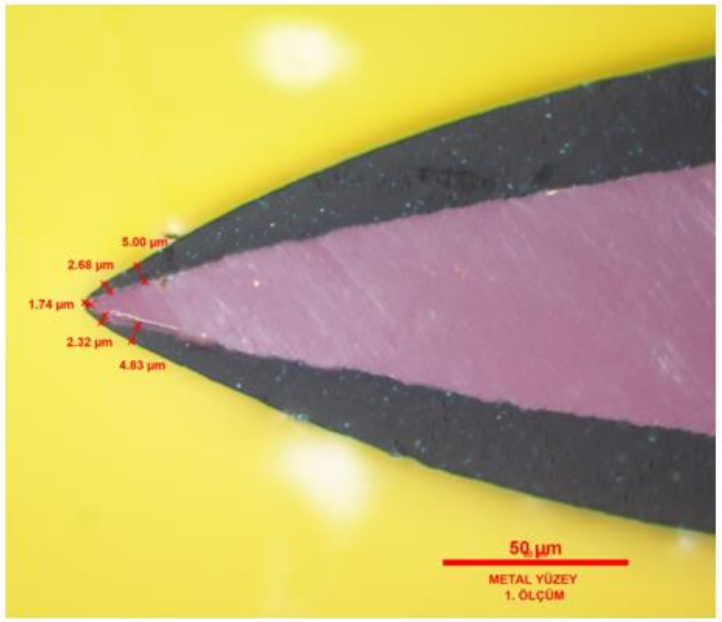


Edge Coverage

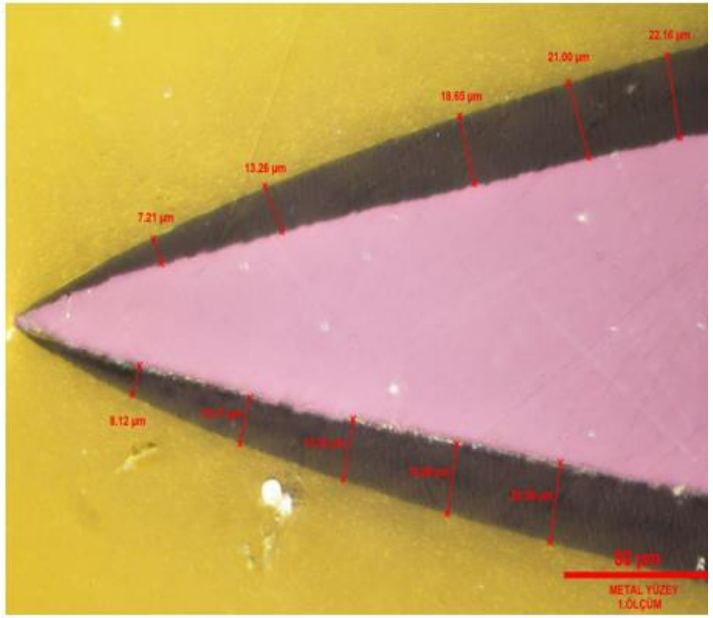
Formulation-A:



Formulation-B:



Formulation-C:



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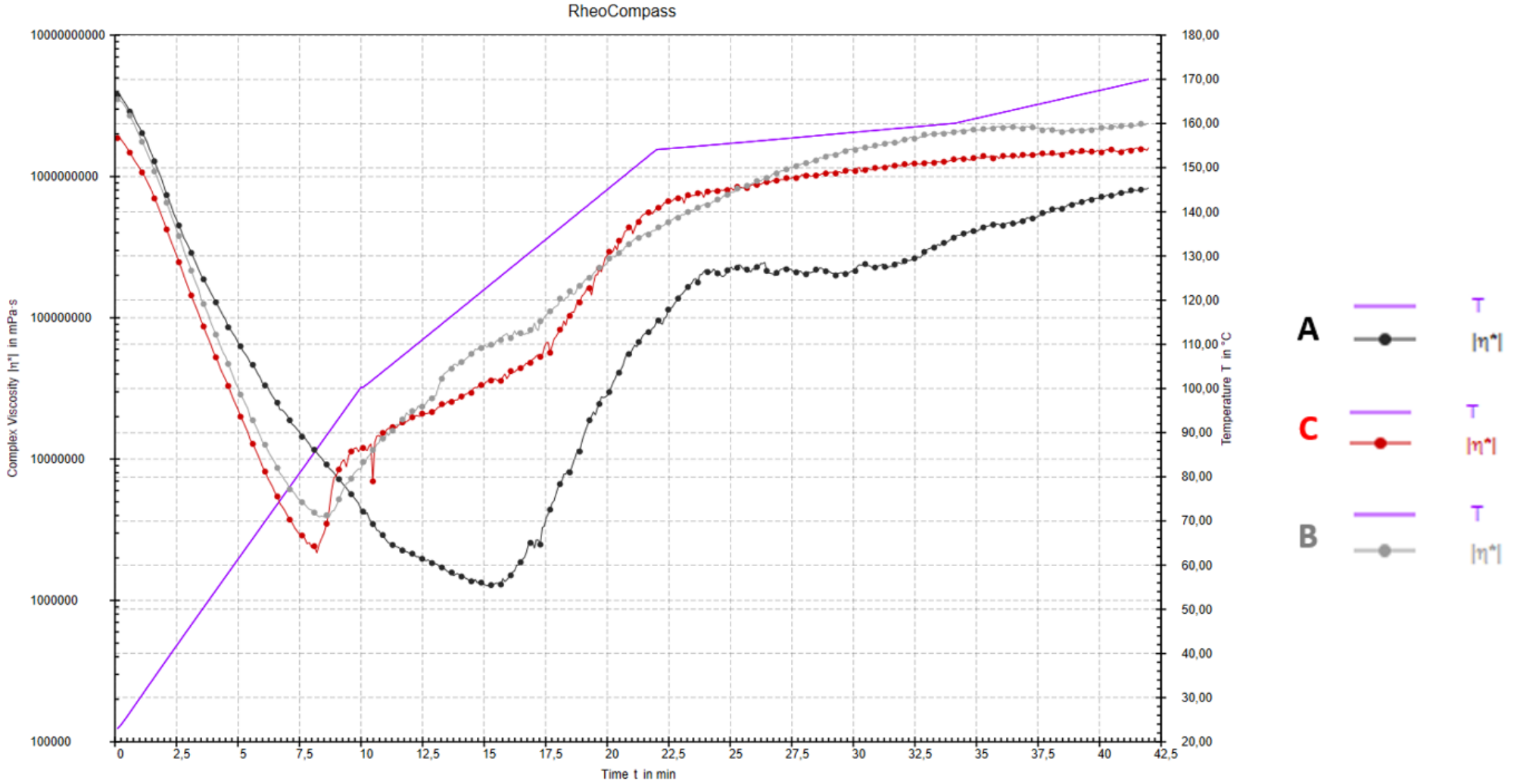
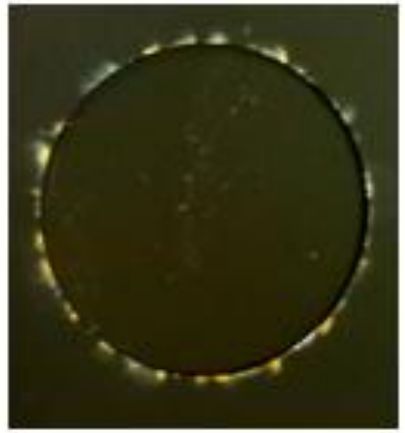
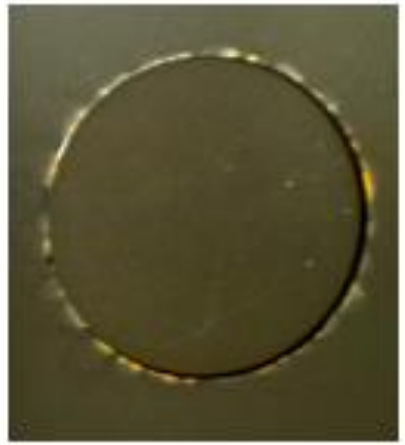

RheoCompass
Complex Viscosity |η*| in mPa·s
Temperature T in °C
Time t in min
A
T
|η*|
C
T
|η*|
B
T
|η*|

Formulation-A:

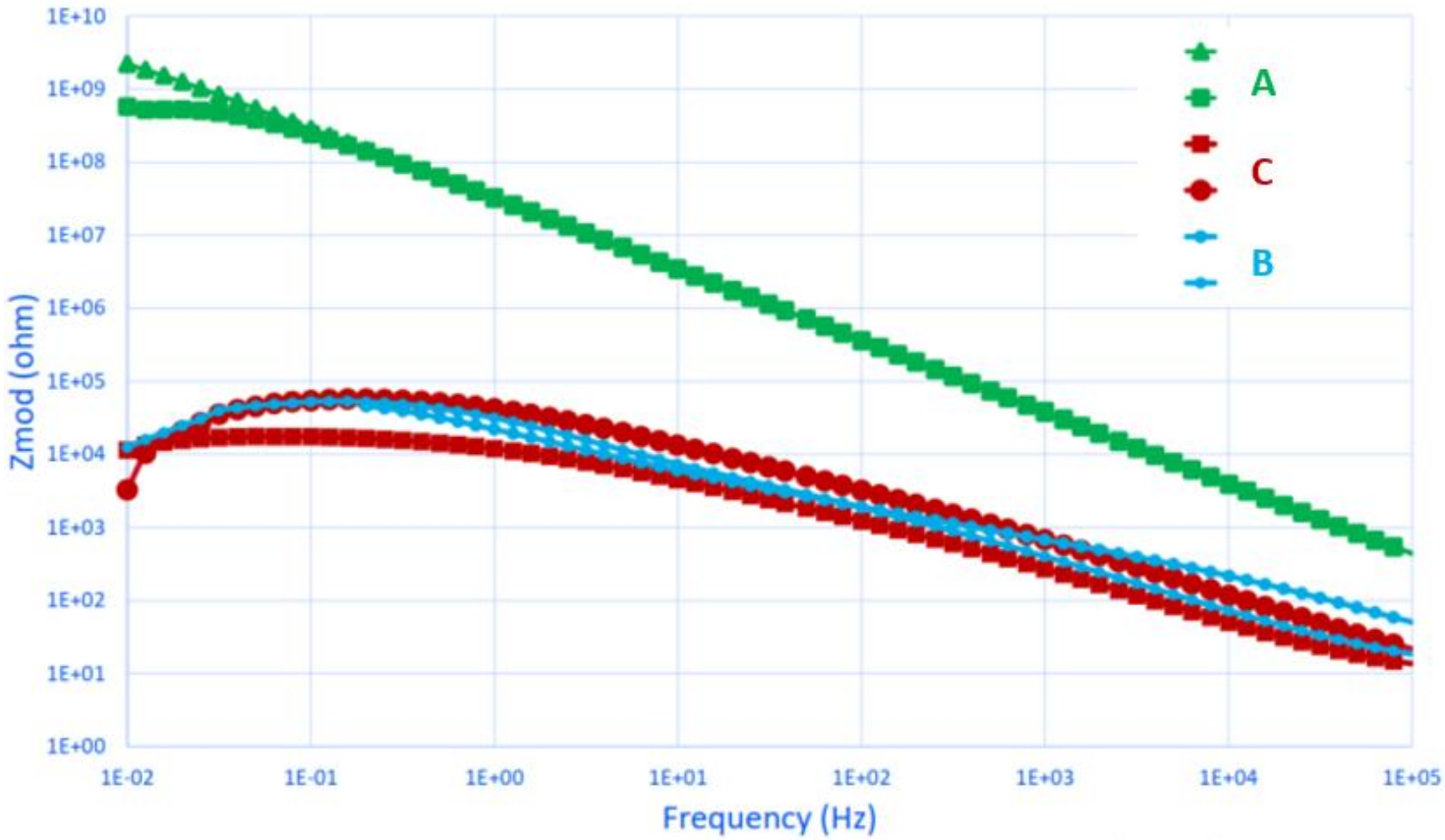
Formulation-B:

Formulation-C:





Bode Plot


1E+10
1E+09
1E+08
1E+07
1E+06
1E+05
1E+04
1E+03
1E+02
1E+01
1E+00
Zmod (ohm)
1E-02
1E-01
1E+00
1E+01
1E+02
1E+03
1E+04
1E+05
Frequency (Hz)
A
C
B

Conclusion

- Edge coverage of an e-coat can be controlled by flow during baking.

- As a result of the flow behavior change, it is highly possible that the appearance of the dry film could be inferior.

Thank you for your attention

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