



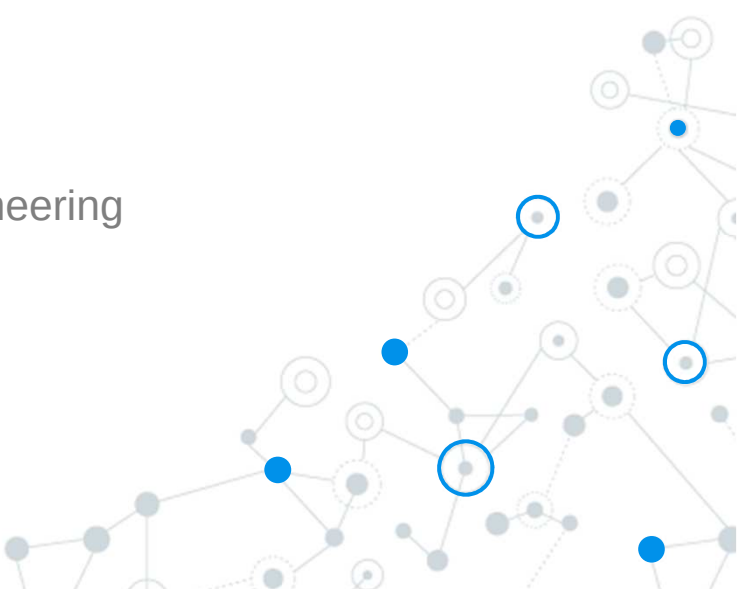
Can the forming limits of coil coatings be dictated by the paint mechanical properties?

A.C. Bastos¹, **A.M. Simões**², **M.G.S. Ferreira**¹

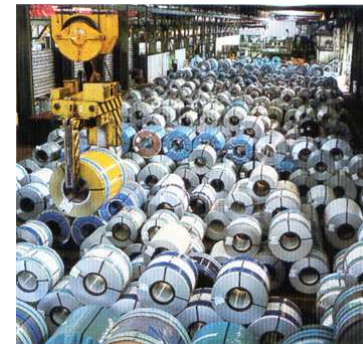
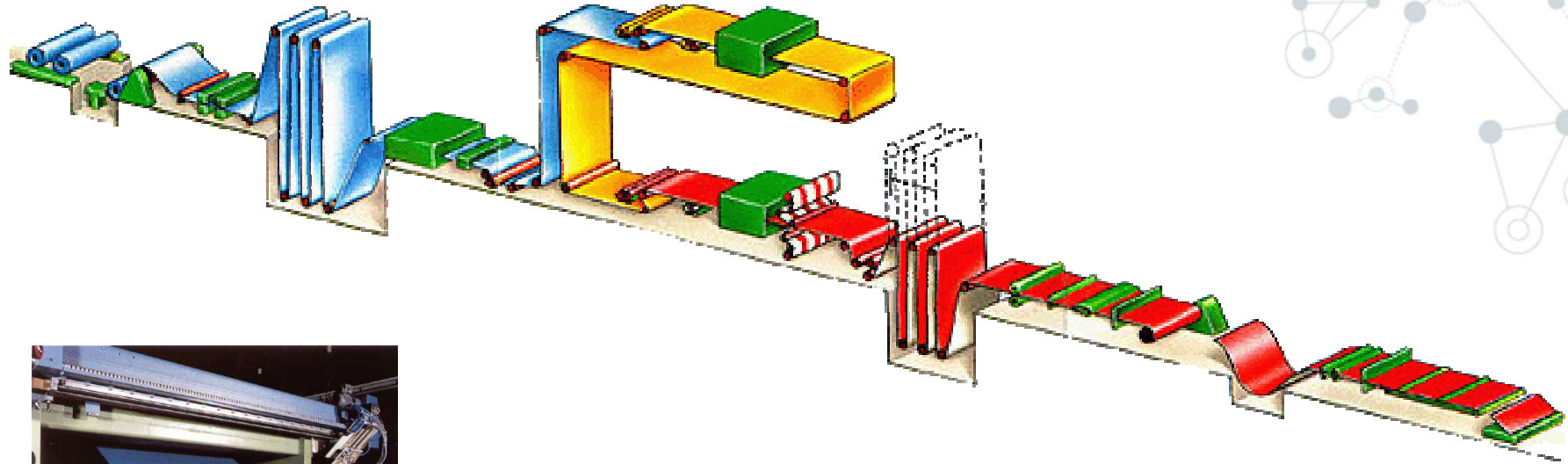
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Coil-coatings



Coil-coatings



Forming limits

Metal integrity

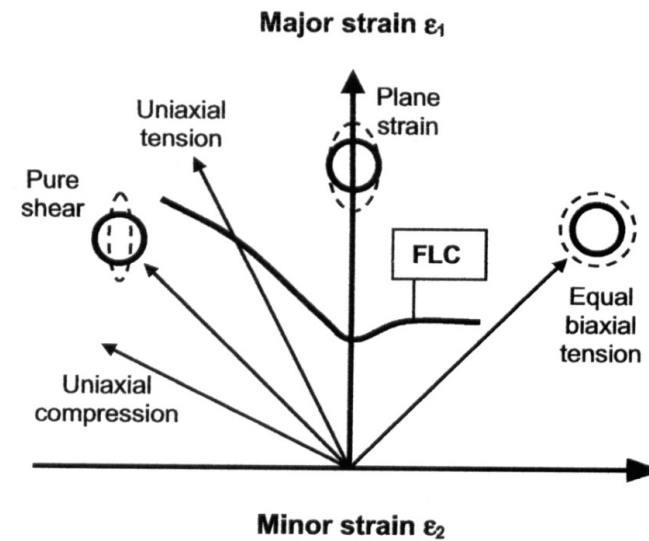
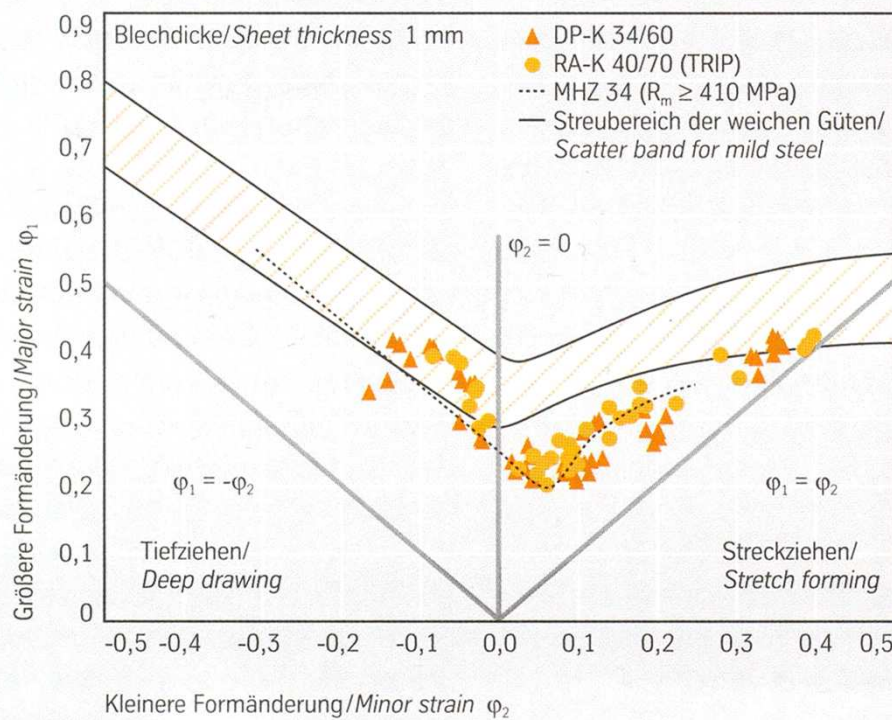
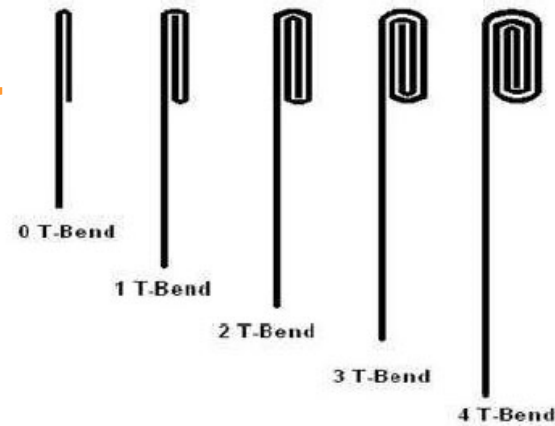


Fig. 1. Forming limit curve.

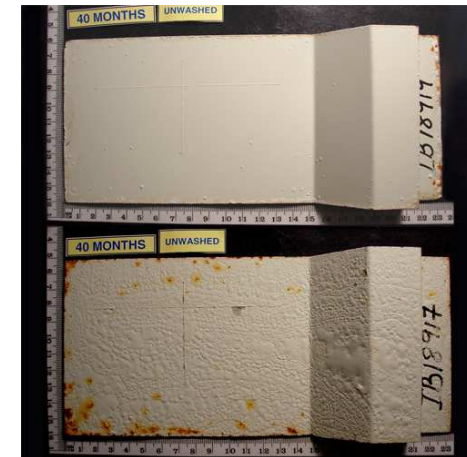


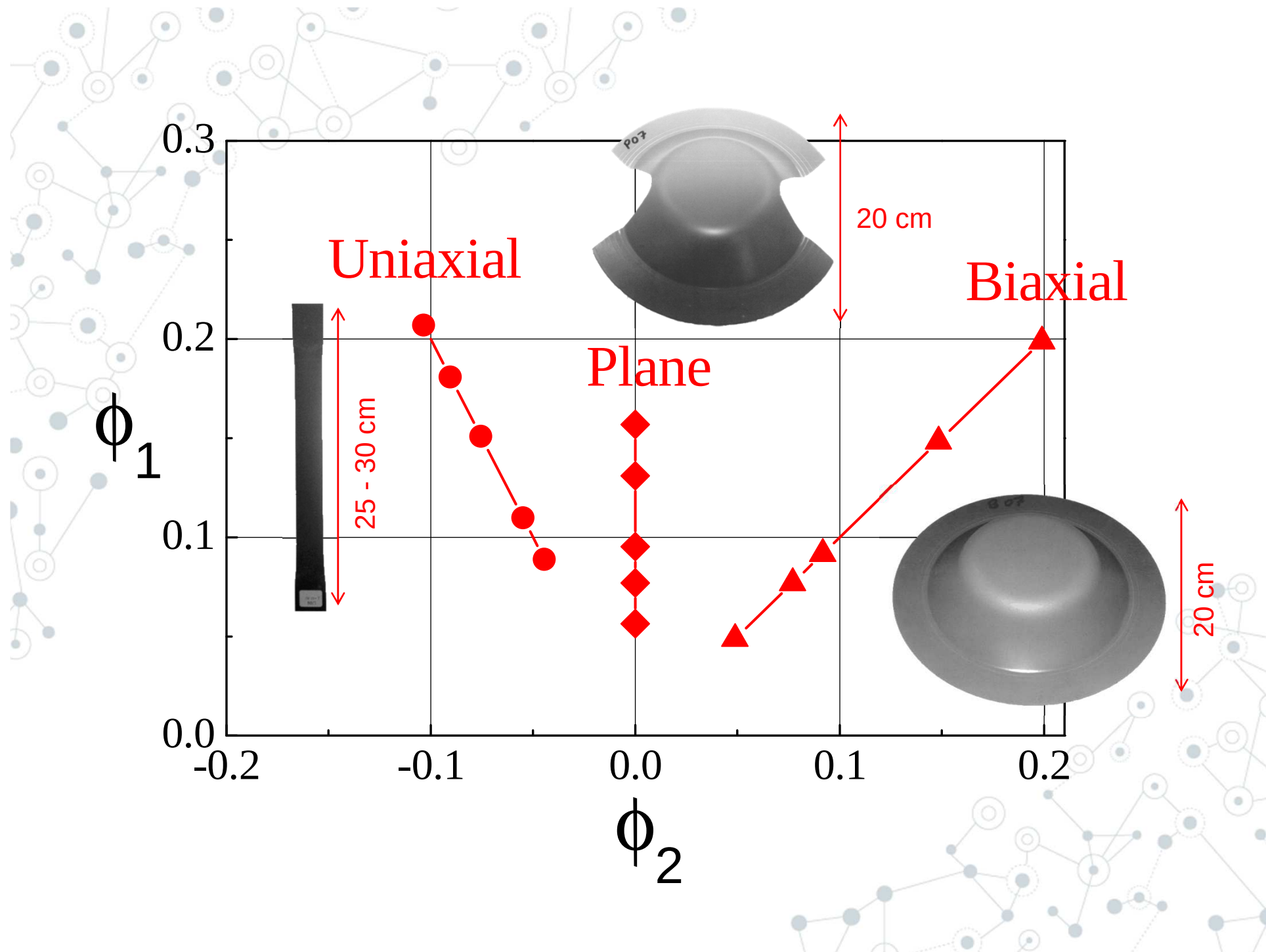
Forming limits

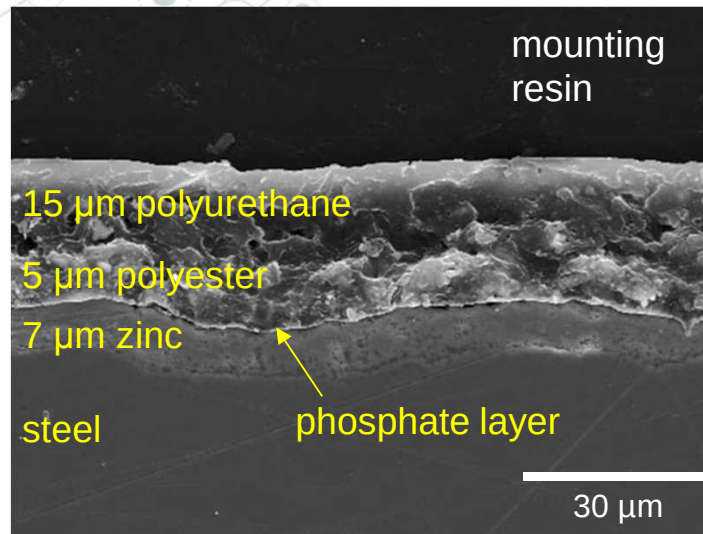
Paint integrity



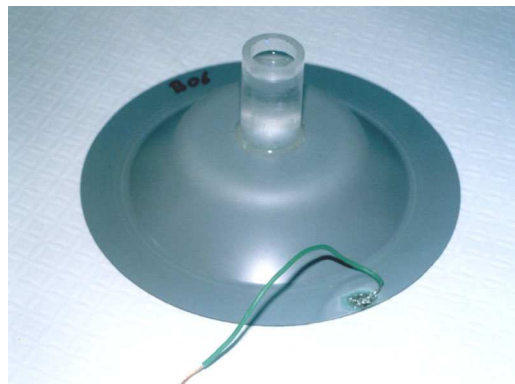
Corrosion resistance



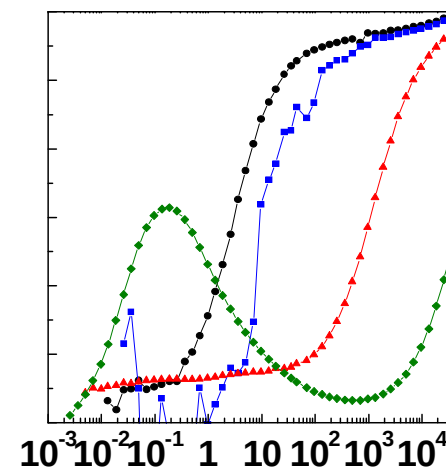
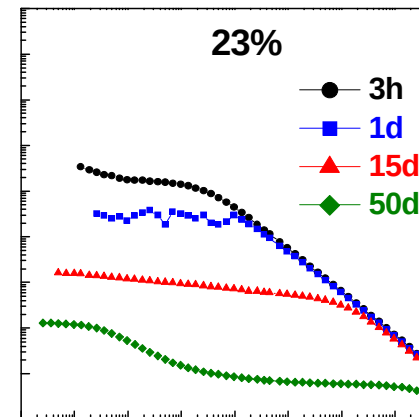
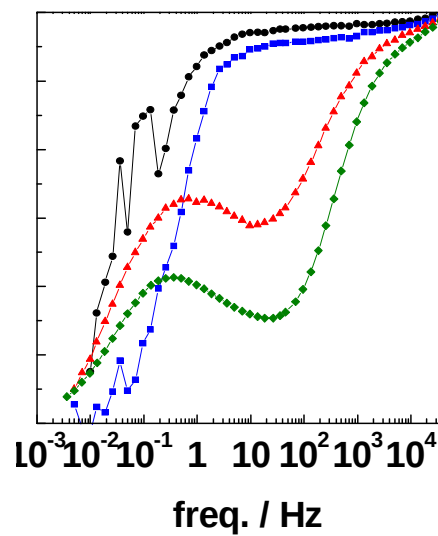
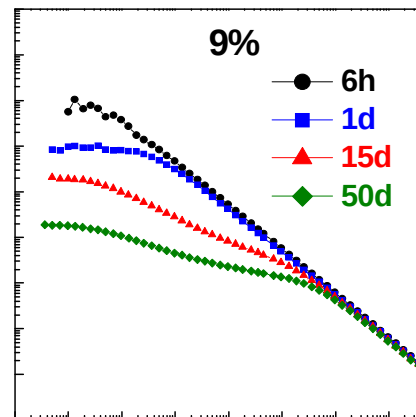
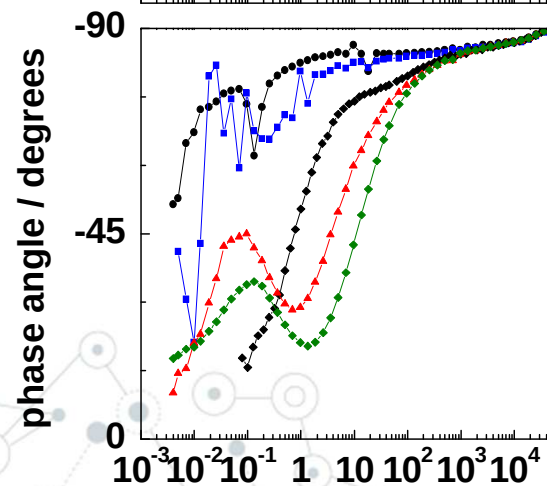
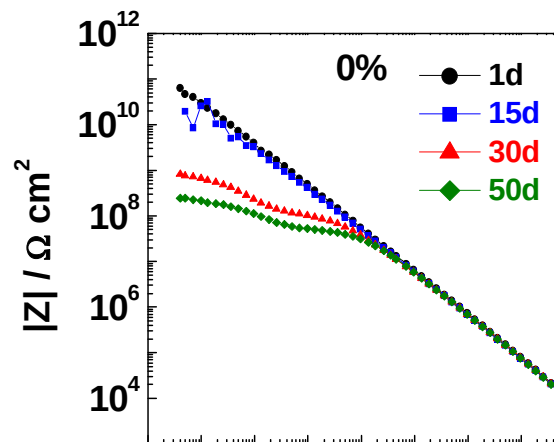
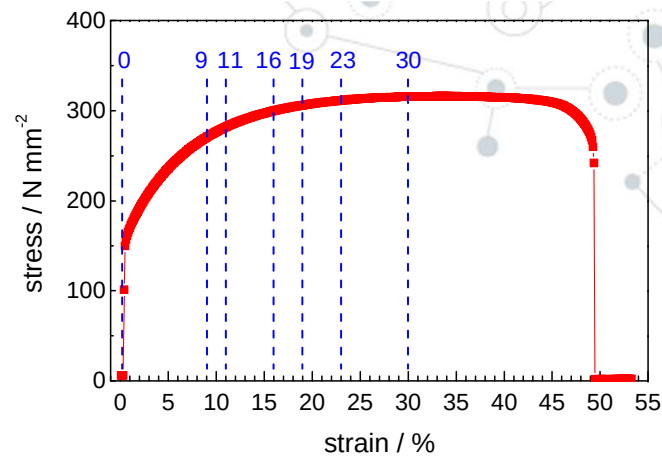




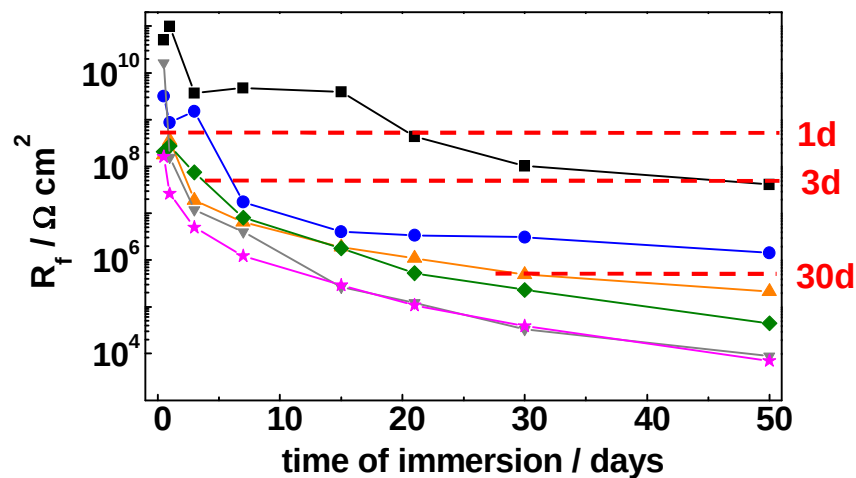
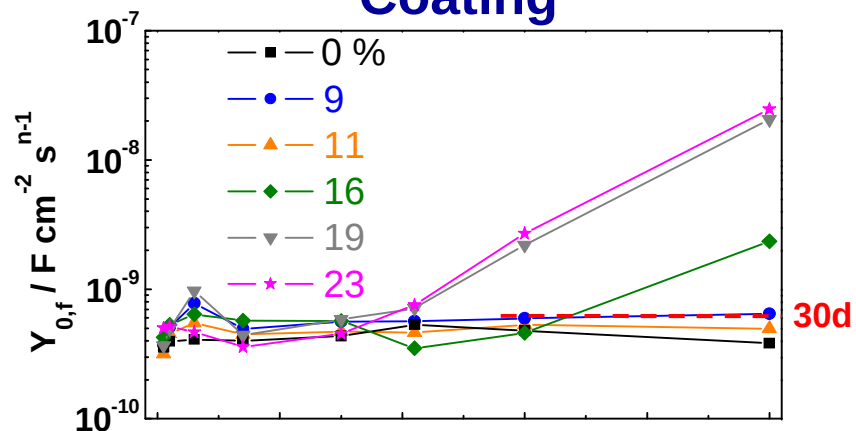
5%NaCl
 10^5 - 10^{-3} Hz; 10mV rms



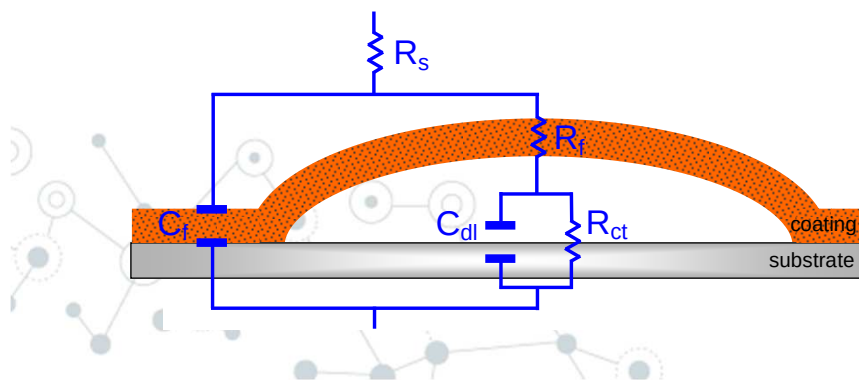
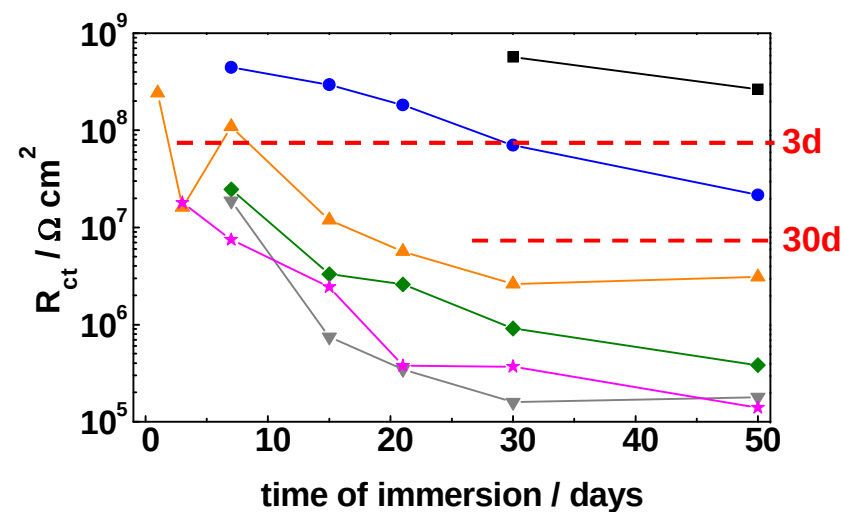
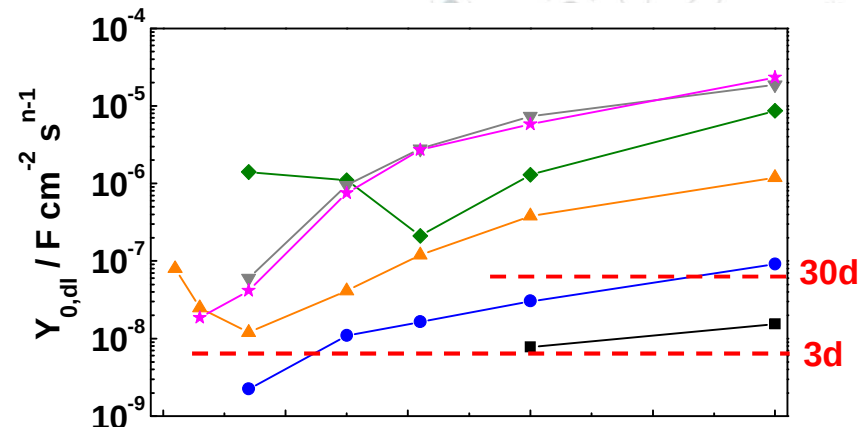
Uniaxial



Coating



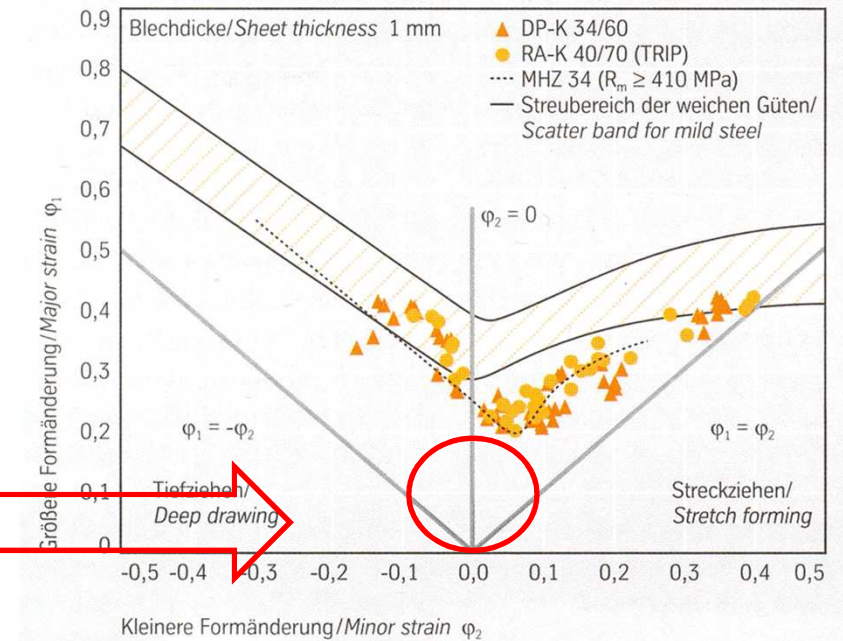
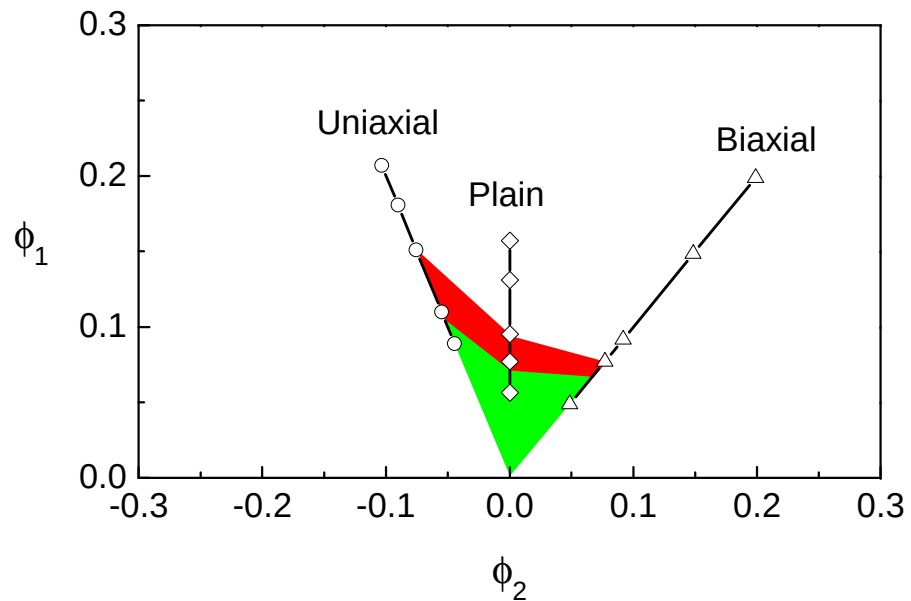
Corrosion



parameter	1d	3d	30d
C _f	< 10 ⁻⁹	< 10 ⁻⁹	< 10 ⁻⁹
R _f	> 10 ⁹	> 10 ⁸	> 10 ⁶
C _{dl}	absent	< 10 ⁻⁸	< 10 ⁻⁷
R _{ct}	absent	>10 ⁸	>10 ⁷
Visual inspection	no signs of attack		
Units: resistance (Ω cm ²), capacitance (F cm ⁻²)			

Forming Limit Curve

Progress in Organic Coatings 80 (2015) 156–163



parameter	1d	3d	30d
C_f	$< 10^{-9}$	$< 10^{-9}$	$< 10^{-9}$
R_f	$> 10^9$	$> 10^8$	$> 10^6$
C_{dl}	absent	$< 10^{-8}$	$< 10^{-7}$
R_{ct}	absent	$> 10^8$	$> 10^7$

Visual inspection

no signs of attack

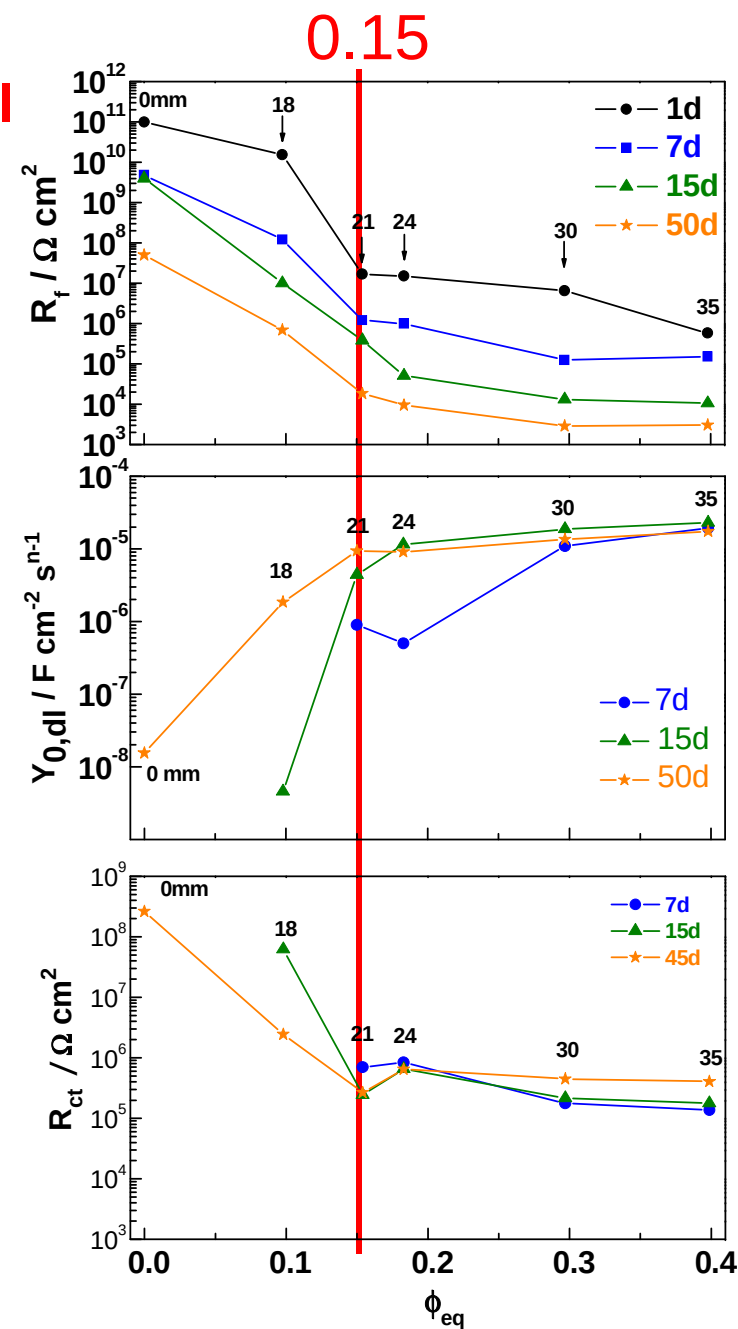
Units: resistance ($\Omega \text{ cm}^2$), capacitance (F cm^{-2})

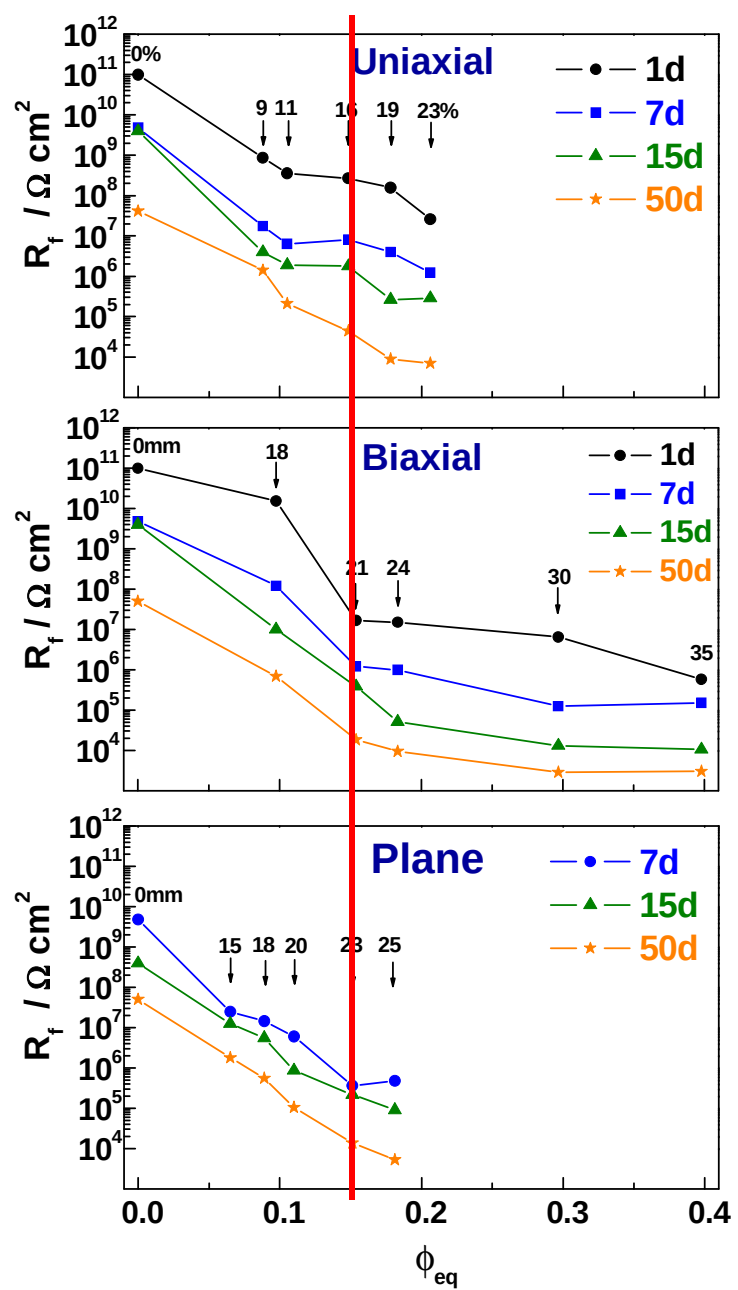
Equivalent plastic strain

$$\varphi_{\text{eq}} = \sqrt{\frac{2}{3} \left(\varphi_1^2 + \varphi_2^2 + \varphi_3^2 \right)}$$

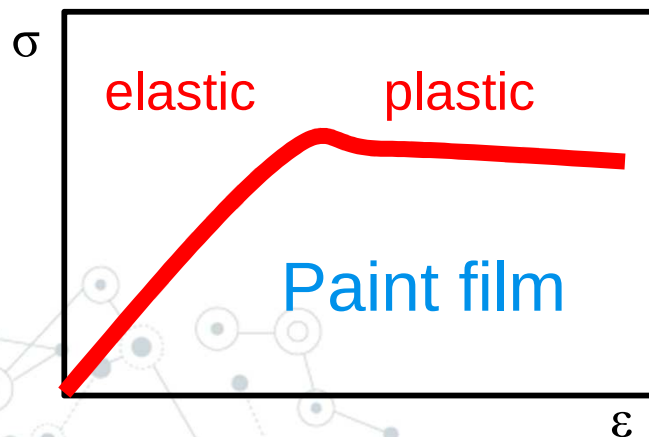
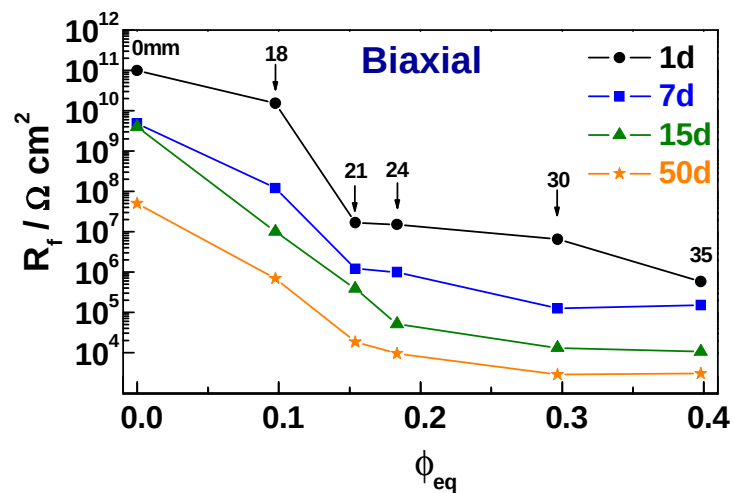


Biaxial

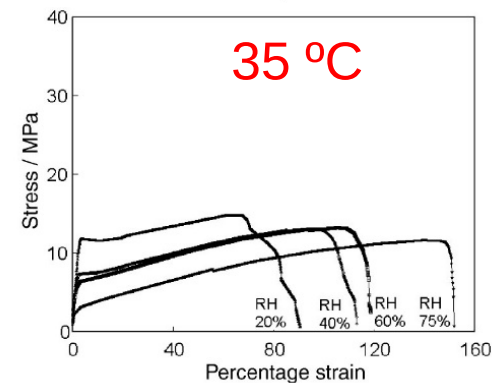
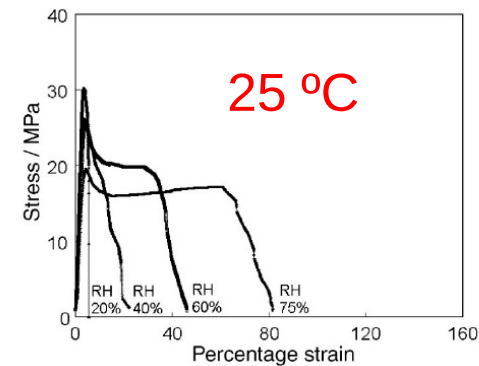
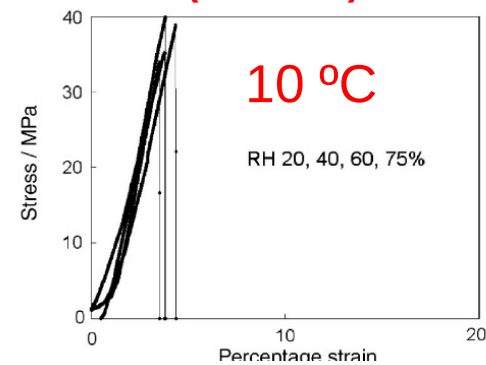




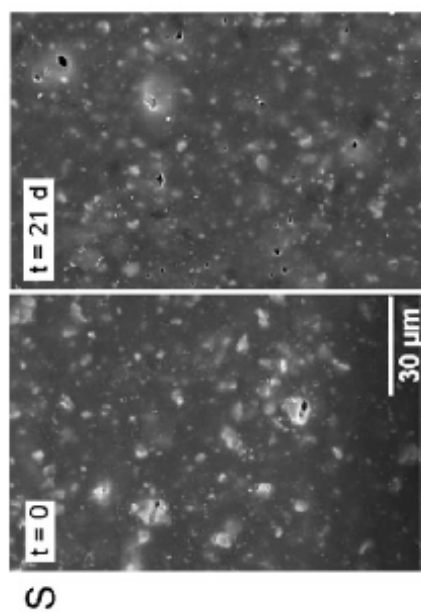
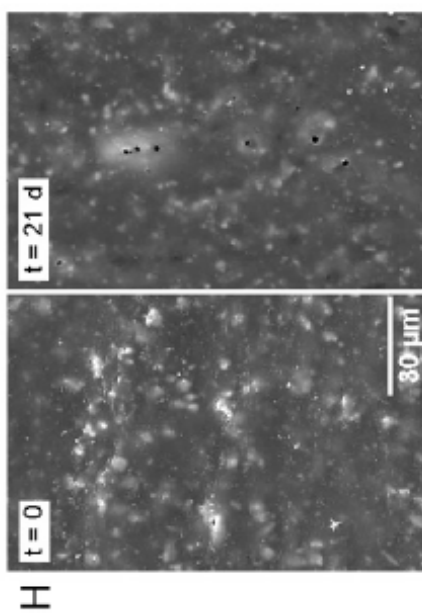
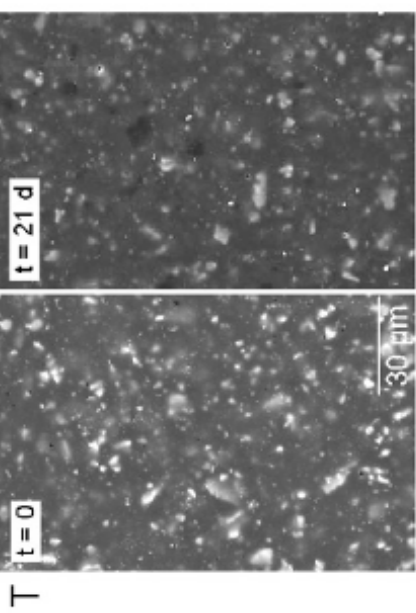
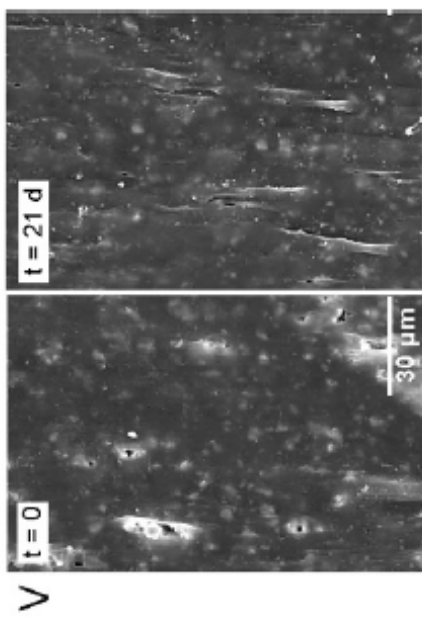
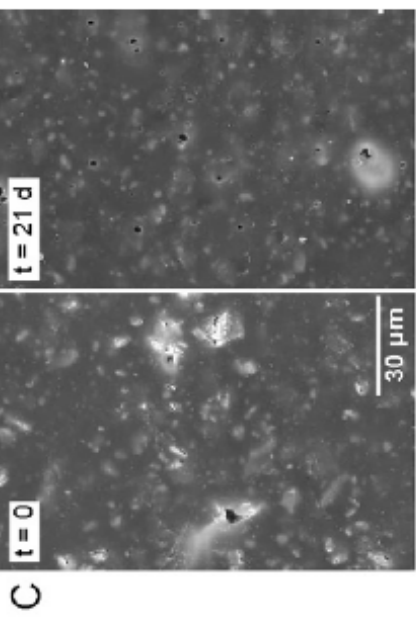
Hypothesis



Polyester-melamine (low PVC)



G.M. Foster, S. Ritchie, K.E. Evans, C. Lowe
Prog Org Coat 51(2004) 244





Can the forming limits of coil coatings be dictated by the paint mechanical properties?

Maybe.

Results suggest it.

Why is this important? If correct, the forming limits of coil-coatings regarding corrosion resistance can be anticipated simply by the coating stress-strain curve.



MAYBE NOT SO SIMPLE...

- Polymer
- Pigments size and shape
- PVC
- Surface pre-treatments
- Number of layers and thicknesses
- Temperature, humidity and strain rate during forming



Acknowledgements

ECSC

Funding under the contract n° 7210-PR/189.

ThyssenKrupp Stahl (Germany)

For the samples, GOM evaluation and FEM analysis.

Dr. Guido Grundmeier

*(Max-Planck-Institut für Eisenforschung,
now at the University of Paderborn, Germany)*
for many useful discussions.

SMARCOAT

Funding from the European Union's Horizon 2020 research and innovation programme under the Marie Skłodowska-Curie grant agreement N° 645662.

