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Improving zinc-rich epoxy primer performance with conductive polymer incorporation

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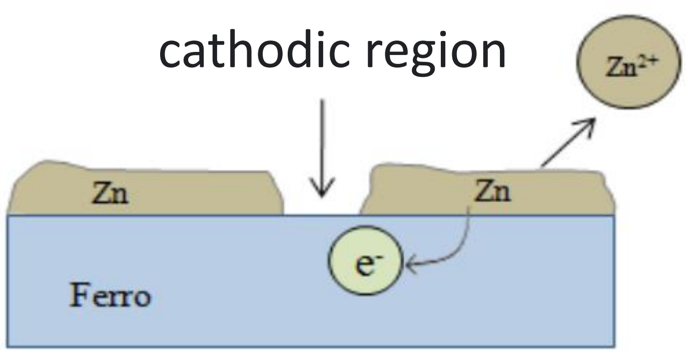
Zinc Rich Paints (ZRPS)

- Painting of structures exposed to atmospheres is the most commonly used form of corrosion protection for carbon steel.

- Zinc Rich Paints (ZRPs) are widely used today and are considered one of the most effective carbon-steel corrosion protection method. ZRPs are characterized by having high metallic zinc content in the dry film to guarantee the electrical contact between pigments.

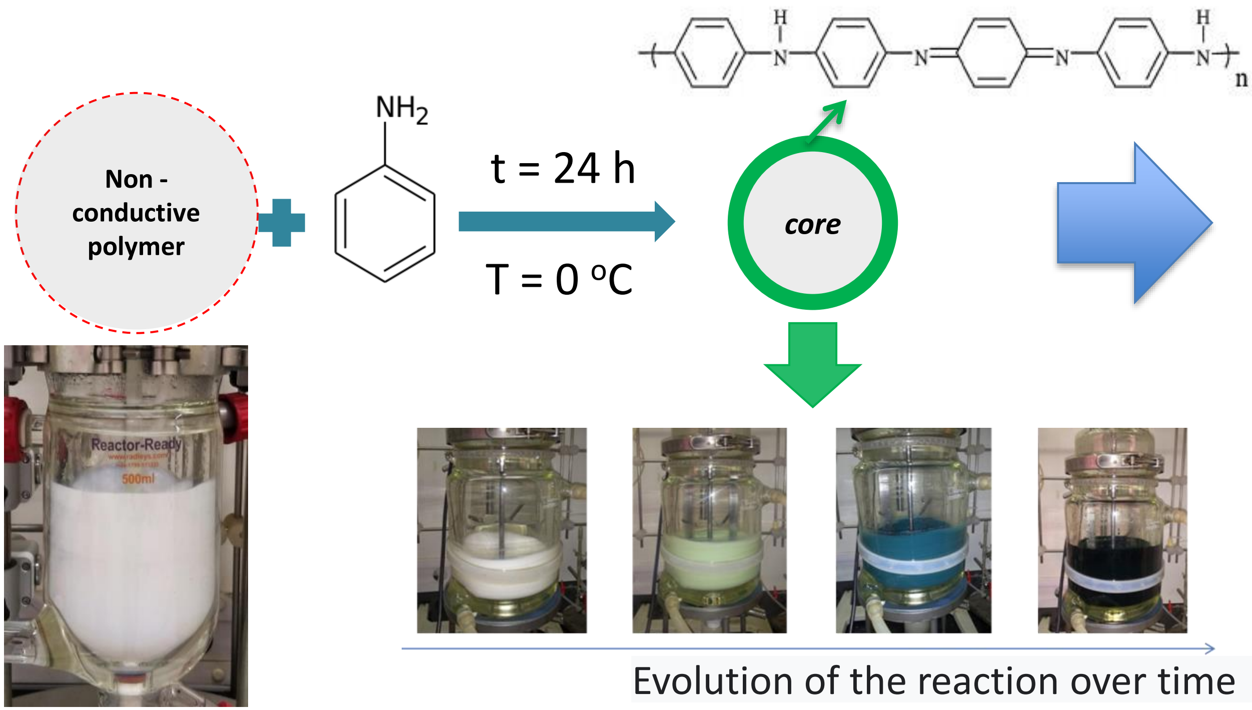
- There is a trend to reduce the levels of metallic zinc because of the mechanical properties (adhesion and cohesion), application, storage of paint (decrease sedimentation), and the fact that the cost of paints increases with the zinc content.



Particles of core-shell (CS) type were synthesized:

- Core is an acrylic copolymer (non-conductive polymer) was produced by emulsion polymerization;
- Shell is the polyaniline (conductive polymer) produced by aniline polymerization.

These particles were incorporated in ZRP formulation in order to improve the mechanical properties of these new formulations without jeopardizing the electrical properties.

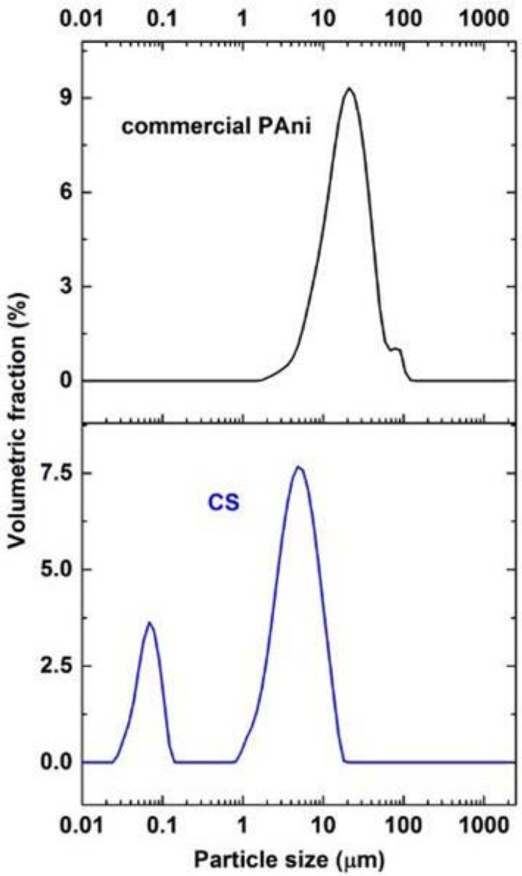


CS powder

Table 1 – Formulation of the ZRP without (commercial) and with polymeric particles

Paint	For coating formulation			For application
	Base formulation (%)	**Zinc powder (%)**	**Core-shell conductive polymeric particle (%)**	**Curing agent (%)**
Commercial ZPR	19.3	77.3	-	3.4
ZRP with CS	22.8	72.7	0.19	4.4

Characterization of conductive polymeric particles and comparison with commercial PAni



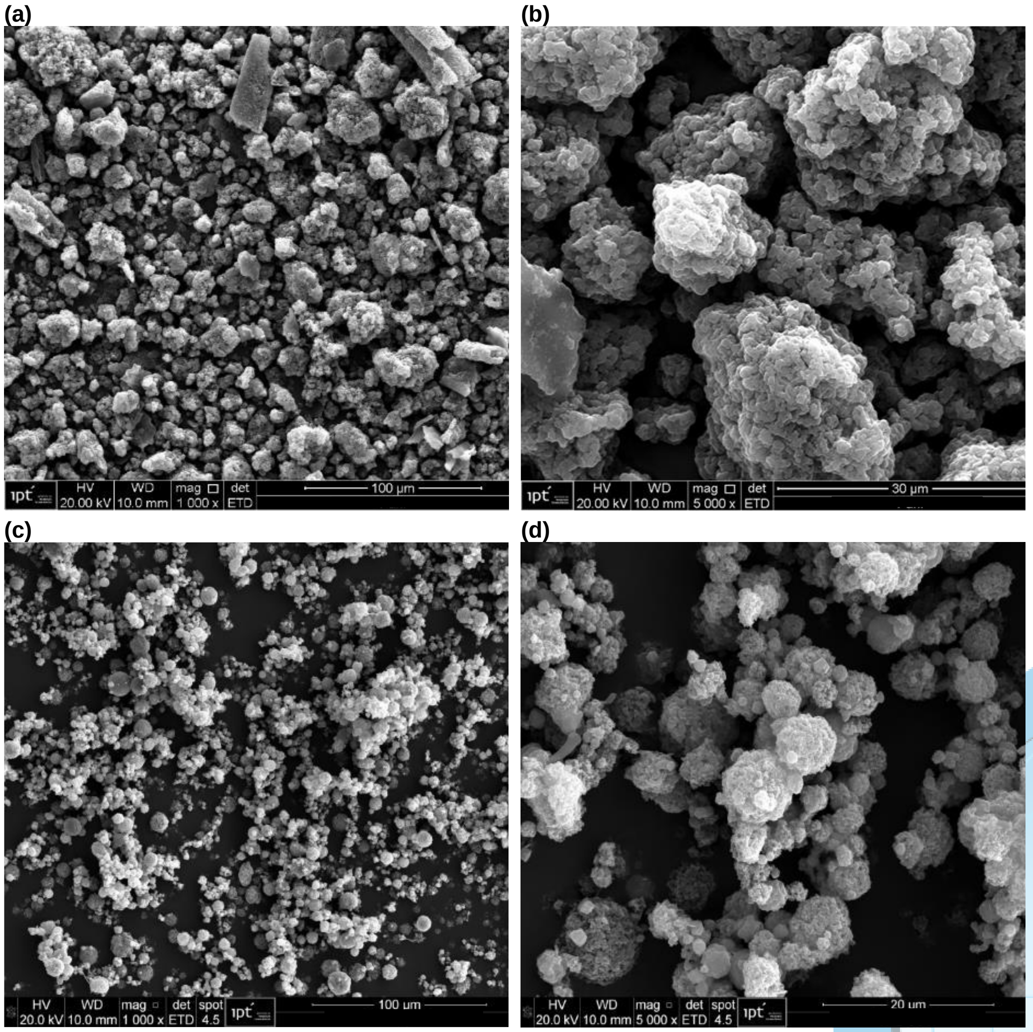


Figure 1 - SEM microphotographs of commercial PAni (a) 1000 X and (b) 5000 X; and CS particles after spray dryer (c) 1000 X and (d) 5000 X.

Table 1 – Specific surface area and conductivity of commercial PAni and CS particles

Sample	BET (m^2/g)	Conductivity (S/cm)
Commercial PAni	6.2	6.8×10^{-2}
CS	10.5	5.4×10^{-2}

Characterization of commercial and modified ZRP

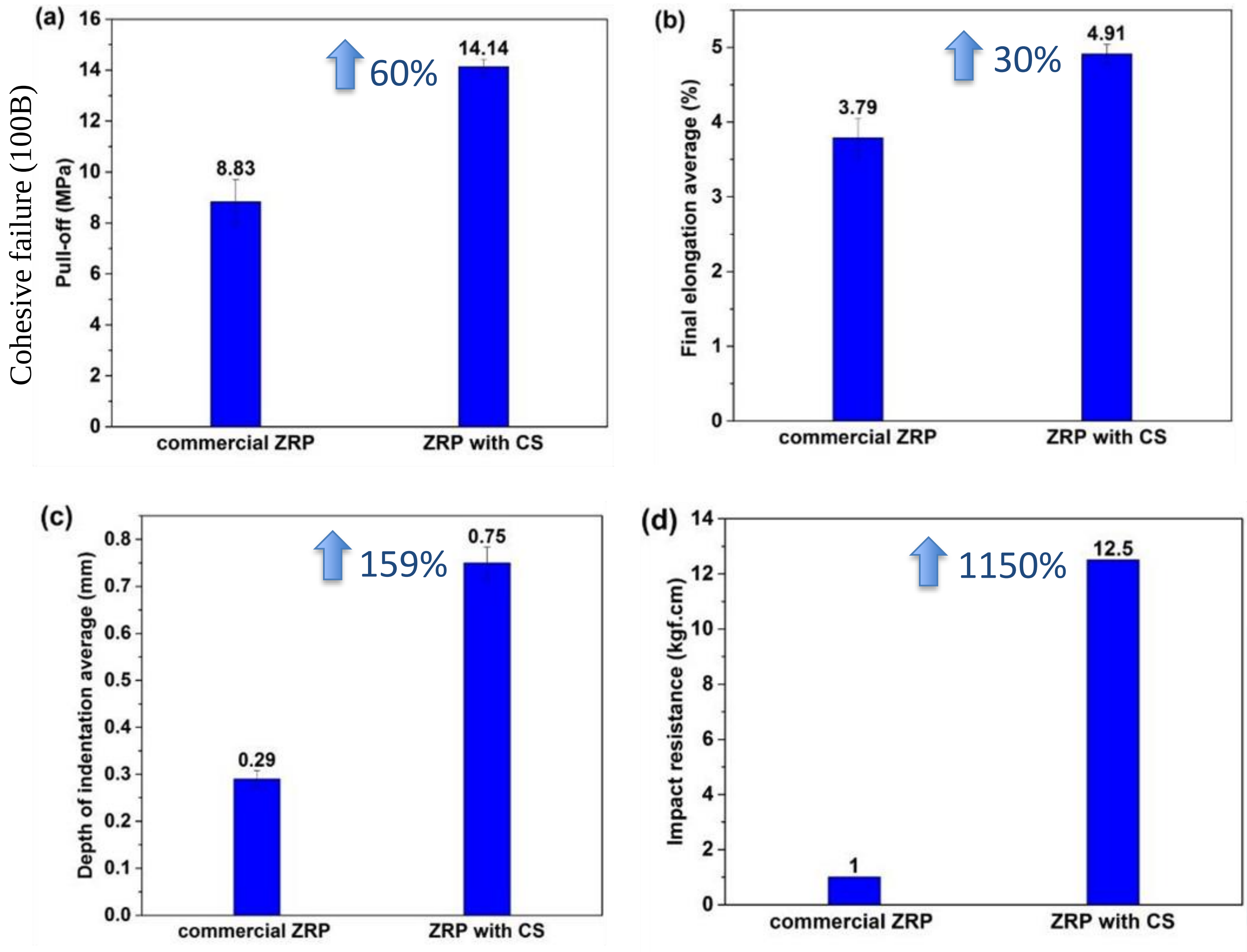


Figure 1 - Mechanical properties of commercial and modified ZRP: (a) Pull-off adhesion test, (b) conical mandrill bend test, (c) Erichsen cupping test and (d) impact resistance

Conclusions

- The new ZRP formulation allowed a reduction in zinc content by adding alternative polymeric conductive particles and by increasing the resin concentration. Both factors were responsible for the mechanical improvement of the dry film, resulting in better adhesive and cohesive properties between the dry film and the metallic substrate.
- The mechanical improvement did not jeopardize the coating electrical properties, due to the presence of conductive polymeric particles, responsible for establishing and maintaining the electrical contact between the zinc particles.

Thank you !!!

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