SYNTHESIS AND APPLICATION OF BIO-BASED THERMOSETTING RESINS IN PLATING ON PLASTICS

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The problem

❖ **Plastics** are **non-conductive,** therefore PoP requires an initial electroless plating layer (chemical plating)
❖ Prior to electroless, PoP requires two surface pretreatment steps: **Etching and activation**

1 *Cleaning/Etching with CrO_3 solution*

Cr(VI) used for etching in PoP process is a highly toxic and carcinogenic chemical restricted by REACH.

Metallization

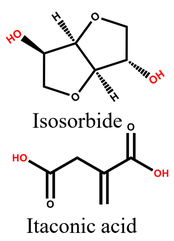
2 *Activation* — Pd, Sn

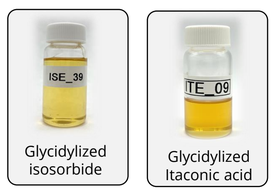
Pd(II), that is used as a colloidal solution with Sn, is a very expensive chemical considered as a Critical Raw Material in EU.

Green solution: **Bio-based epoxy or epoxy-acrylate polymers with embedded metallic nickel (Ni) nanoparticles as conductive intermediate layer on plastics**

Experimental

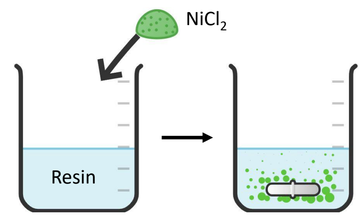
SYNTHESIS OF BIO-BASED RESINS





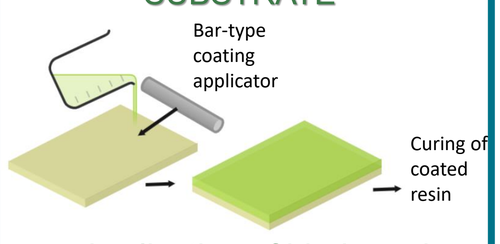
Synthesis of epoxy and epoxy-acrylate resins derived from isosorbide and itaconic acid

Ni-salt COMPOSITE PREPARATION



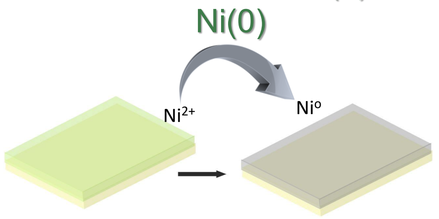
Dispersion of Ni salt in the bio-based resin using magnetic stirring and sonication

COATING ON ABS SUBSTRATE



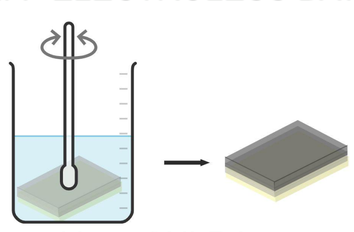
Application of bio-based composite as coating on ABS substrate

REDUCTION OF Ni(II) TO Ni(0)



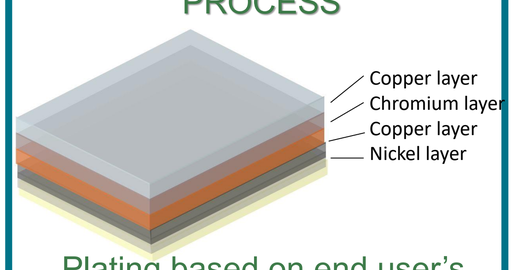
Reduction of Ni^{2+} to Ni^{o} in $NaBH_4$ solution

Ni-P ELECTROLESS BATH



Deposition of Ni-P layer on the substrate via electroless plating

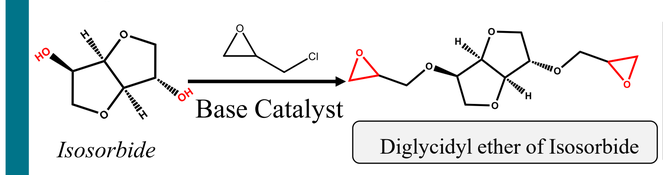
ELECTROPLATING PROCESS

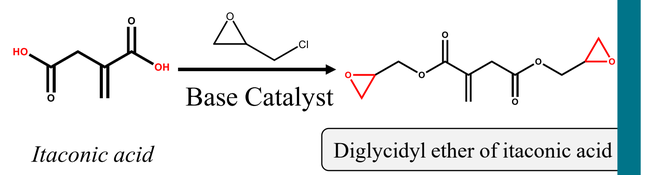


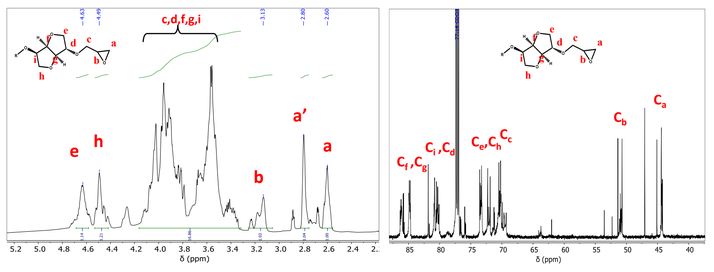
Plating based on end user's specifications

Results & Discussion

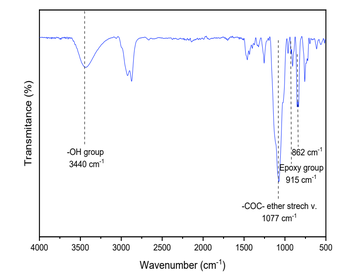
➢ Synthesis of resins





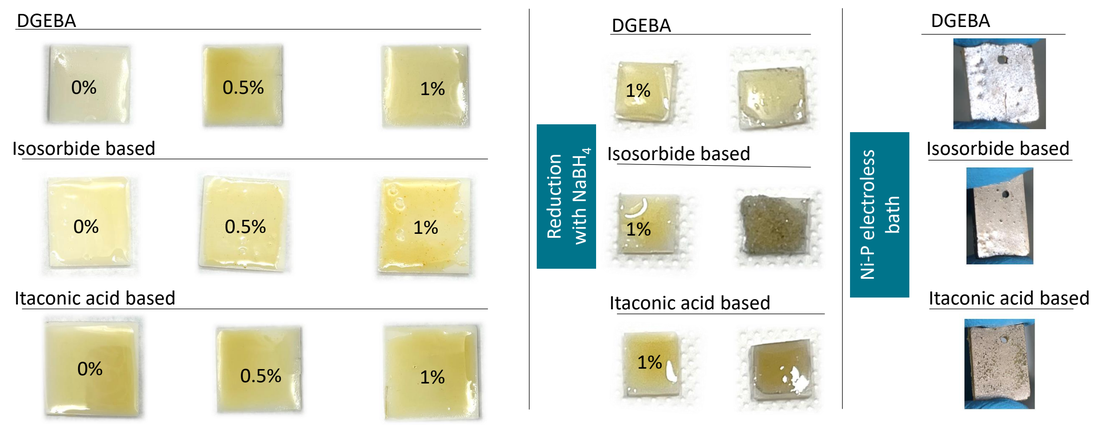


^{1}H-NMR & ^{13}C-NMR spectrum of glycidylized isosorbide (up) and itaconic acid (down).

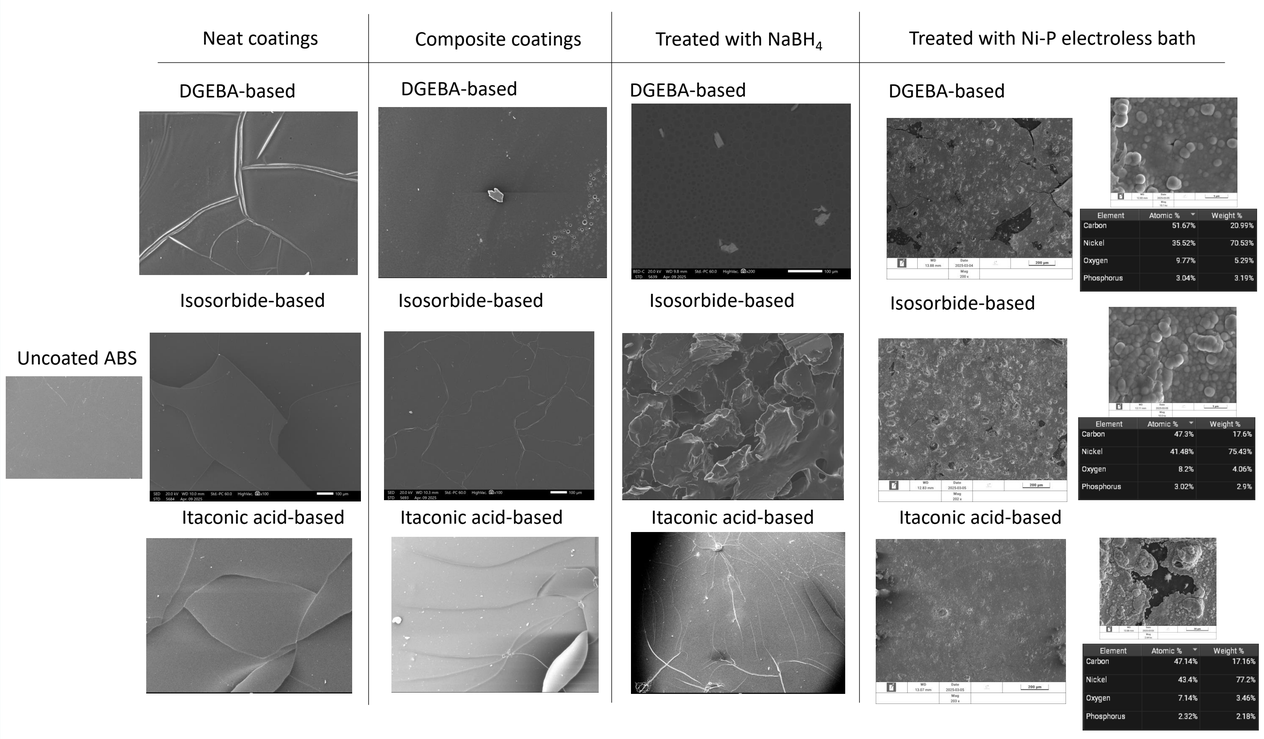


FTIR (ATR) spectrum of glycidylized isosorbide (up) and itaconic acid (down)

➢ Composites with $NiCl_2$ coated on ABS, reduced and plated with Ni-P



➢ SEM/EDX analysis



Conclusions

- Successful functionalization of itaconic acid and isosorbide toward bio-based resins with yields over 60%.
- Bio-based epoxy polymers were successfully characterized by means of NMR, FTIR and titration methods.
- Coatings of bio-based and conventional resins were successfully applied on ABS.
- It is macroscopically evident that treatment with $NaBH_4$ alters the physical appearance of the surface from yellowish to dark grey/black while Ni^{+2} species are reduced to Ni^{0}
- SEM/EDX showed that the best Ni-P layer was coated on isosorbide based coated support.

Contact

Check me out!

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