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Bio-inspired interfaces for the development of next generation degradable multi-phase materials - InsBIOration

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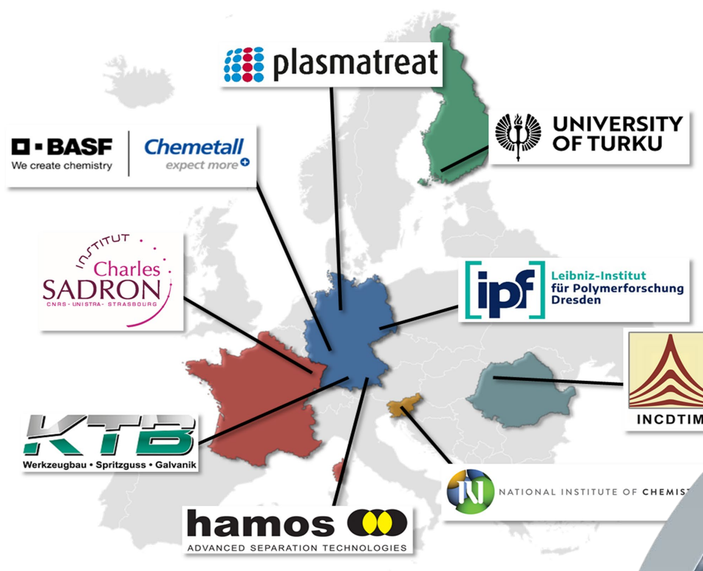
Research scope of InsBIOration

Creating more sustainable production chains involves a wide range of possibilities, from product design to the hot burning **3Rs** (reduce, reuse, recycle). The final impact, even of slight improvements, is tremendous in the case of mass production. If the demand for a sustainable mindset is rethought in a technological context, a product is always based on the use of materials and their combination into **circular composites or hybrids** using **environmentally friendly manufacturing processes**.

Consortium and their Research Synergies

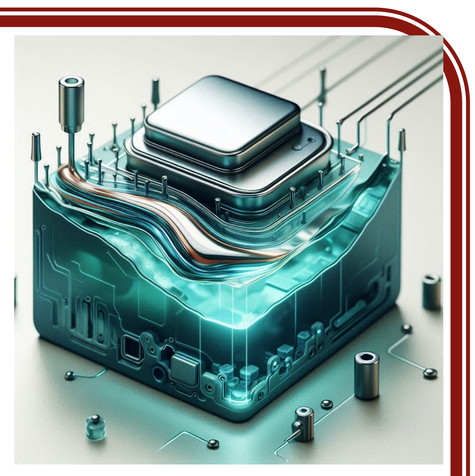


- ✓ **6 partners** from **5 countries** and
- ✓ **3 associated industrial partners**

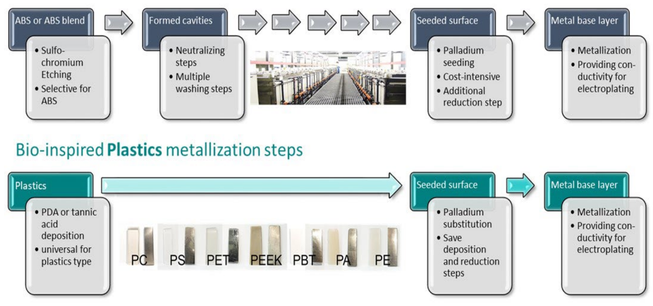
Metallizied Plastics

The metallization of plastic surfaces is widely used for decorative and functional purposes. The state-of-the-art pre-treatment of chrome-plated plastic parts bases on etching the plastics surface with toxic and hazardous chromosulphuric acid. This method is restricted to few polymers; 90% of galvanized parts are made of ABS or ABS-containing blends because it is the only polymer that can be roughened. Neutralization and lots of washing steps follow pre-etching.

Our studies on PDA for plastics metallization revealed that PDA films enable the formation of metal films on different plastic types as substrate material processed by wet chemical as well as electroplating technologies.



State-of-Process: **Plastics** metallization process chain



Bio-inspired **Plastics** metallization steps

Creating more sustainable production chains involves a wide range of possibilities, from product design to the hot burning 3Rs (reduce, reuse, recycle). The final impact, even of slight improvements, is tremendous in the case of mass production and meets interest of metallization industry.

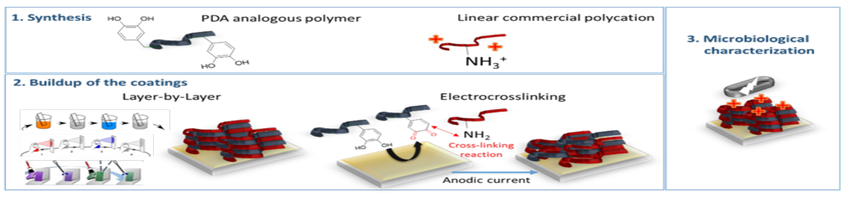
There are three major strategies for designing antipathogenic coatings:

I) anti-pathogenic agent release,

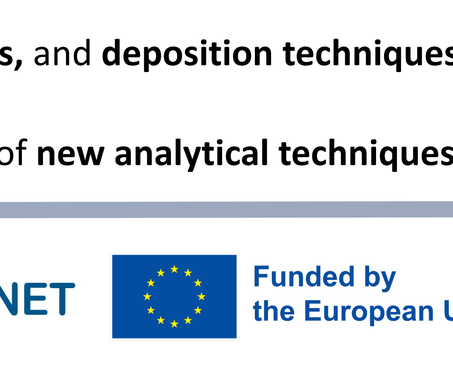
II) contact-killing by physical lysing or membrane perturbation with positively charged polymers (polycations),

III) anti-adhesion/bacteria-repelling agents based on poly(ethylene glycol) or zwitterionic polymers.

PDA has been studied for its antibacterial properties. Several mechanisms are involved in the generation of Radical Oxygen species, via conversion of environmental oxygen (O_2) to superoxide radical (O_2^-), hydrogen peroxide and the oxidized form attained different ions of the bacteria. Moreover, PDA has high photothermal conversion properties upon near-infrared irradiation, which leads to the potential killing of all local microbes. The project goes beyond this by developing and immobilizing PDA inspired polymers with improved antibacterial activity and synergetic effects by combination with polycations known to be antibacterial.



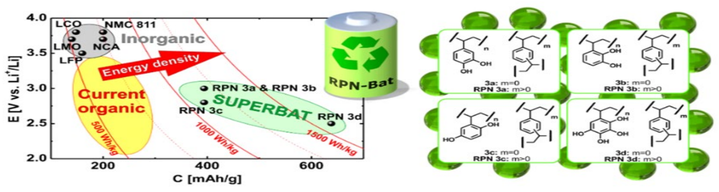
Antipathogenic coatings



Current Li-battery technologies use toxic elements, such as Ni, Co, and V. One promising and feasible partial solution is the emerging field of transient electronics, devices intended for short-term use, which decompose afterwards as a result of external conditions. They require biodegradable power sources.

Biodegradable or conducting polymers have been used in transient electronics but relatively little work has been done to date on their materials, fabrication and performance enhancement.

The project pursues to develop a reproducible, sustainable, and easily upscalable PDA film deposition method, which can easily adopt various other molecules as additional functional components, to be used for batteries, supercapacitors and in other applications.



Bio-degradable Power Sources

Conclusions

- ✓ Investigation of PDA as universal adhesion promoter platform for **in-process technologies,** and **deposition techniques without organic solvent use**
- ✓ Study of **fundamental mechanisms** for new material designs and focus on development of **new analytical techniques**

InsBioration

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