Developing water-based reversible adhesives for zero-waste industries

Adriana Sierra-Romero
School of Engineering, Newcastle University, Newcastle Upon Tyne, NE1 7RU

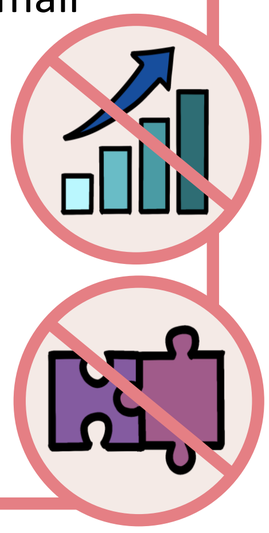
Why do we need reversible adhesives?

- Countless products are not recycled or repurposed because they cannot be disassembled due to the adhesives they contain, ending up in landfills.
- There is a pressing need to reduce waste for environmental reasons:
  - Generation of microplastics, which contribute to long-term pollution.
  - Limited availability of landfills.

We need reversible adhesives to achieve a zero-waste economy.

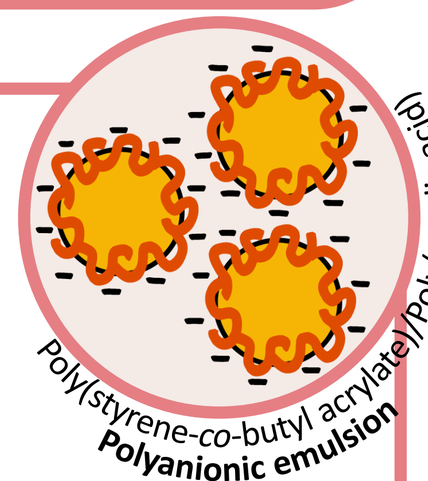
The Challenge

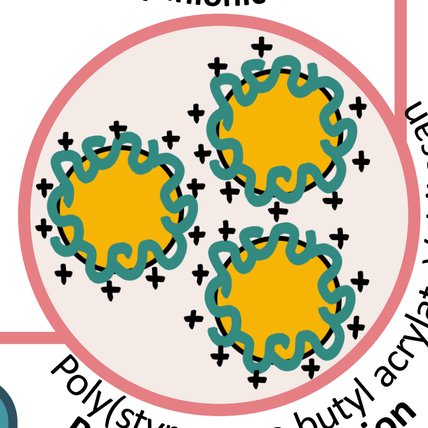
- Adhesives are often underestimated because they represent only a small fraction of the final product.
- Reversible adhesives have been developed, but they are limited regarding:
  - Scalability in production.
  - Scalability in detachment.
  - Substrate compatibility.



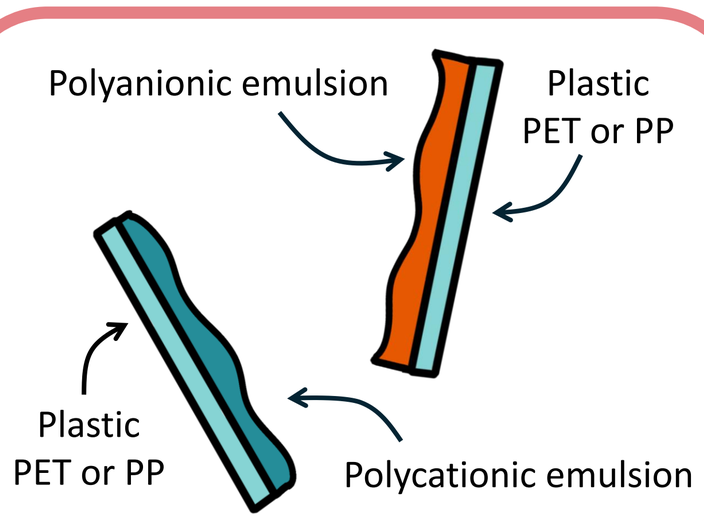
Our Solution

- ✓ Water-based adhesive.
  ⟶ Advantage over solvent-based adhesives.
- ✓ Produced by emulsion polymerisation.
  ⟶ Conventional manufacturing process.
- ✓ Good shear adhesive strength.
  ⟶ Up to 1.5 MPa (White glue: 1-5 MPa).
- ✓ Reversible.
  ⟶ Immersion in acidic or alkaline media.
- ✓ Works on various substrates.
  ⟶ Plastics and metals.

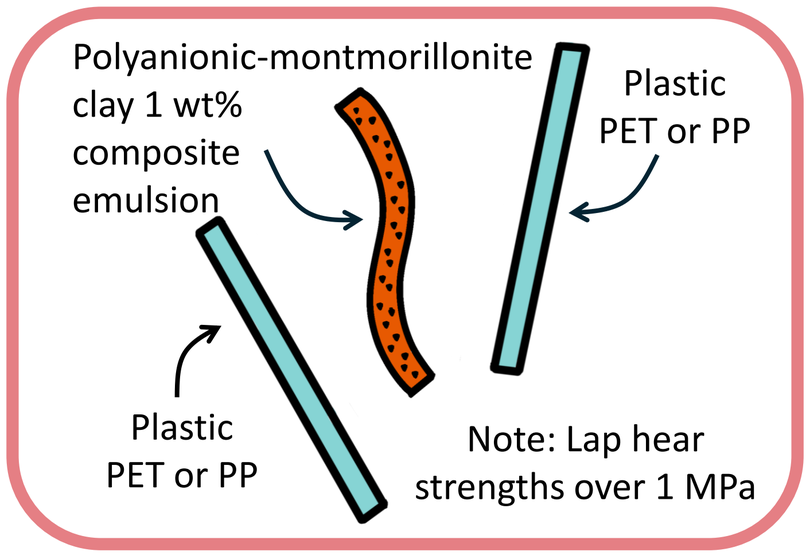




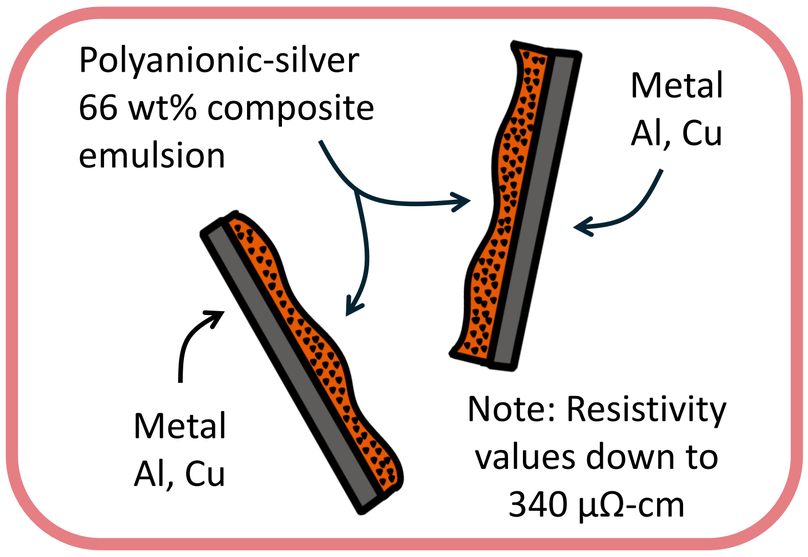
How does our reversible adhesive work?



Acid solution, HCl pH 1 or
Alkaline solution, NaOH pH 14
48 h, 21 °C, at rest



Alkaline solution, NaOH pH 14
24 h, 21 °C, at rest or
1 h, 85 °C, 500 rpm stirring



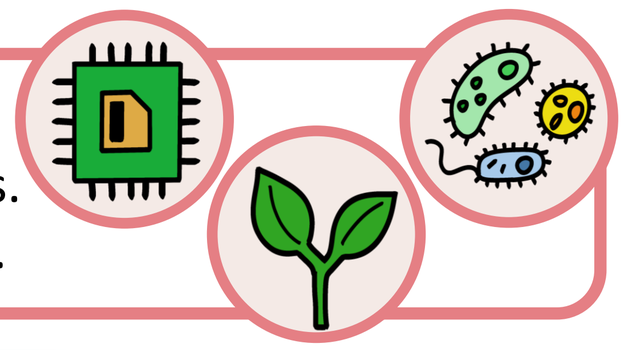
Alkaline solution, NaOH pH 14
24 h, 21 °C, at rest

Key message: Our reversible adhesive is water-based, is made from commodity materials, is scalable, and is reversible in an alkaline media already present in plastic recycling facilities.

Ongoing Work

How versatile can our adhesive be?

⟶ Reversible adhesive for electronics.
⟶ Antifouling and antimicrobial coatings.
⟶ Formulations from bio-based sources.



References
A. Sierra-Romero, K. Novakovic, M. Geoghegan, *Angew. Chem. Int. Ed.* 2024, 63, e202310750. https://doi.org/10.1002/anie.202310750

Team members:
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