

# QUT Reversible Adhesive Technology for the Circular Economy

## The Issue

Although the adhesives and coatings market is large and varied, it's mostly limited in its end of life considerations. The vast majority of the solutions permanently adhere to surfaces, making them difficult to economically disassemble and recycle on scale.

The primary reversible adhesive solution in the market is are melt adhesives. While this may be occasionally useful, their rigid material properties critically limit product variety. What is needed in the market is a tailored adhesive that fits into your product's design specifications in all applications.

## The QUT Solution

QUT has ownership and broad commercialization rights for an impactful range of materials that can provide control to tailor the reversibility of adhesives and coatings.

By working with on-market adhesive polymers and focusing on the cross-linking chemical, the QUT technology has broad applicability to existing industrial applications. This is achieved through novel and customized linkers that can be cleaved on-demand within the adhesive.

## Potential Applications

Potential applications of the reversible adhesive material may include:

- Product assembly and disassembly (e.g. electronics)
- Footwear
- Packaging
- Building and Construction
- Woodworking
- Automotive and Areospace
- Consumer and DIY

This could be applied as an adhesive or as a coating.

## Key Projected Features & Benefits

Benefits for customers include:

- **Reversible:** Upon heating to a setpoint, the material unadheres
- **Tunable:** Strength and reversible temperature can be customized to defined setpoints
- **Ubiquitous Applicability:** Due to using known polymer adhesive base systems, the QUT technology is assumed to be compatible with many applications
- **Fast Acting:** QUT's material can be removed within minutes of heating
- **Sustainability Enabling:** Reversible adhesives are a major 'unlock' to achieving complete and economic recycling/recovery of waste materials

## The Opportunity

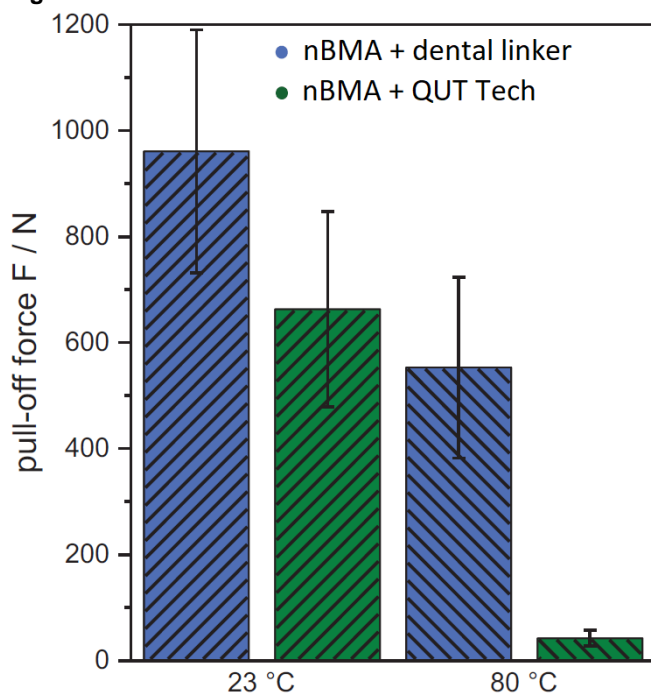
QUT's reversible adhesive technology is currently looking to move to the next stage of technology readiness level as it prepares for entry into a broad range of industries. Having established a proof of concept in the dental field, the innovation is seeking industrial applications beyond dental and commercial manufacturing with its € 30 billion market.

Prior to conducting this next stage of development, QUT is initiating discussions with a range of leading organizations in strategic market segments. QUT wishes to explore tailoring our technology to the market's needs and discuss future partnering options that will realize the benefits of this technology.

## Performance Potential

The QUT technology has performed in promising research studies into the reversibility of the adhesive. Originally developed for dental applications with Ivoclar Vivadent, this technology is at a Technology Readiness Level of 4. Figure 1 is an example of the reversible adhesion, where the examined dental polymer based on n-butyl methacrylate (nBMA) was crosslinked with an industry standard linker and compared to a poly(nBMA) adhesive with the QUT technology linker at both 23<sup>o</sup> and 80<sup>o</sup>C.

**Figure 1: Measured Adhesive Reversal Performance<sup>1</sup>**



To the best of QUT's knowledge, the approach taken with this technology is a major advance in coatings and adhesion materials science. It is the only known material that can combine high adhesion strength with a fast and simple reversibility through relatively low temperature increases.

Conducting this process in minutes opens key opportunities in materials handling and product recovery. Our technology is critical for end-of-life considerations for new products due to the reduced cost of separating materials during recovery. The common temperature ranges for disassembly are compatible with simple off-the-shelf equipment and may even be enabled with waste heat from other processes.

More information can be found in the granted national phase patents ([linked here](#)) and Schenzel A. et al. *Adv. Sci.* **2016**, 3, 1500361.

## The Way Forward

If your organization is interested in discussing the opportunity to explore our technology, please advise us of any additional information you require. At your convenience, a meeting can be arranged.

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