Self Healing Coatings

- Repair irreversible defects in coatings and epoxy resins without buffing, polishing or erosive loss
- Maintain the functionality of layers underneath
- No degradation of the healing properties

Lead scientists
- Dr Kei Saito
- Dr George Simon

Opportunity
Our scientists have developed a self-healing epoxy polymer. Incorporating a diamine cross-linker and using its temperature-dependence and kinetics, cracks and flaws on thermosetting coatings (such as epoxy resin) may be healed or repaired.

Applications
There are potential for many applications for self-healing epoxy resins. The current technology has its greatest application as a protective coating.
It could therefore be used:
- To repair scratched paints and coatings in the automobile, office furniture or ophthalmology sector;
- To develop new epoxy resins and thermoset materials.

Technology
This invention relates to epoxy resins that exhibit thermoset characteristics. Built on infusible, insoluble cross-linked polymer chain networks, these branched epoxy resins also show self-healing properties.

The healing process is based on the multi-amine retro Diels-Alder reversible reaction. Once activated by heat (directly or indirectly by convection, conduction or irradiation), the resins character turns from 'thermoset' to 'thermoplastic' allowing the polymer chain to flow and heal the scratched surface.

Cooling the resin enables the Diels-Alder adducts to reform so as to reinstate 'thermoset' character of the resin.

The proof of concept has been demonstrated by the researchers. They were able to repeatedly heal a common scratched epoxy monomer, DGEBA, associated with diamine cross-linker. They have a clear understanding of the curing conditions and thermal self-healing properties.

Intellectual property
The intellectual property is protected by a PCT application (PCT/AU2013/000518) that claims epoxy compounds, their derivatives and the method of preparing such compounds. It also covers a method of repairing by heat a resin including one of the aforementioned compounds notably by inducing a retro Diels-Alder reaction.

Key publications

Key contact:
Julian Vultaggio
Business Development Associate
julian.vultaggio@monash.edu
+61 3 9905 5007

Figure legend: Images of a scratche (40μm in width) in a cross-linked epoxy polymer sample heated at 110°C for (a) 0 seconds, (b) 0.16 minutes, (c) 1.66 minutes and (d) 4.45 minutes. The heating rate was 50 °C min⁻¹.