UNIVERSITY OF LIMERICK OLLSCOIL LUIMNIGH | Technology Transfer Office

Licensing Opportunity

Adhesive Composition

Overview

Thermoset adhesives offer many advantages over mechanical fastening including very high strength, gap-filling ability, and resistance to humidity, heat, and corrosion. Thermoset adhesives also have the advantage over mechanical fastening (e.g. welding, riveting) in terms of weight reduction, joint stress distribution, efficiency, and convenience of use. Thermoset adhesives such as epoxy resins are used across a range of industries and have many applications including automotive, electrical and electronics, construction, composites, and wind turbines.

One of the main disadvantages of the use of these adhesives is the difficulties associated with disassembling adhered structures without causing damage to the bonded structure materials. This creates difficulties where disassembly is necessary for inspection, repair, replacement of component parts, or effective recycling and reuse. Overcoming this difficulty has positive implications for the sustainable use of materials, the circular economy, and achieving UN Sustainability Goals.

Technology

University of Limerick researchers have created a modified thermoset adhesive that can be effectively degraded by dielectric heating. Dielectric heating is a process by which radio frequency microwave energy can heat a non/low electric conductive (dielectric) material. Destruction of the adhesive bond does not damage the bonded materials (for plastic and composite materials tested). Dielectric absorption materials are distributed in the adhesive and act as localised ‘hotspots’ to absorb and conduct heat into the surrounding adhesive causing it to rapidly degrade (30 seconds - 3 mins). The modified adhesive retains the bonding advantages demonstrated by traditional thermoset (epoxy) resins but their bonding is reversible.

Benefits

The primary advantage of the reversible thermoset adhesive is the ability to degrade the adhesive without damaging the bonded components. This allows for repair, replacement of parts, and effective disassembly of products and materials for recycling and repurposing/reuse. The use of a reversible adhesive would improve recycling efficiency as less material would be destroyed in the process. This is particularly relevant to the creation of a circular economy.

The adhesive can be degraded remotely from an operator which provides further advantages in terms of disassembly of large-scale and high-volume products *such as electronic components* and some advanced transport structures utilising plastic and/or composite components.

It has been observed that the adhesives are tougher and stronger as a result of the nano dielectric components dispersed in the epoxy. Hence, the reversible element also enhances joint performance under normal operating conditions.

Applications

Bonding applications in aerospace, automotive, wind turbine industries, composites and electronics, and infrastructure.

Commercial Opportunity

The University of Limerick is seeking to license this opportunity or to engage with a commercial or development partner to further the technology.

UNIVERSITY OF LIMERICK OLLSCOIL LUIMNIGH | Technology Transfer Office

Licensing Opportunity

☐Development partner

☒Commercial partner

☒Licensing

☐University spin-out

☐Seeking investment

Adhesive Composition, US Patent Application 16313622

Adhesive Composition, European Patent Office Patent Application: 17733456.2

International Publication Number: WO2018/002064

See also https://pubs.rsc.org/en/content/articlepdf/2016/ce/c6ce01359g

Contact

John Gleeson

Technology Transfer Office

University of Limerick, Ireland

email: john.gleeson@ul.ie

Figures

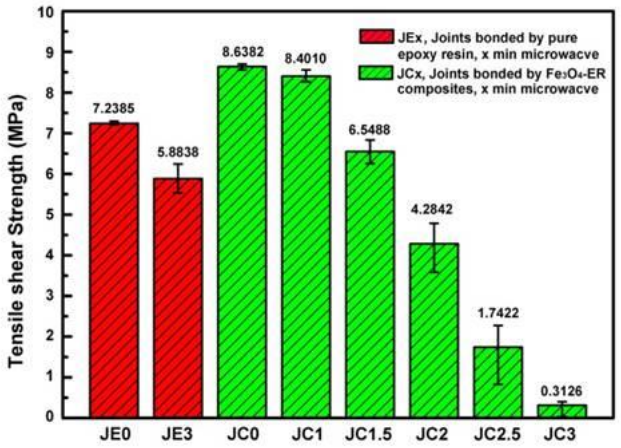

Figure 1: The tensile shear strength of the adhesively-bonded single lap-shear (SLS) joints as a function of microwave irradiation time at 100W 2.45 GHz.

UNIVERSITY OF LIMERICK
OLLSCOIL LUIMNIGH
Technology Transfer Office

Licensing Opportunity

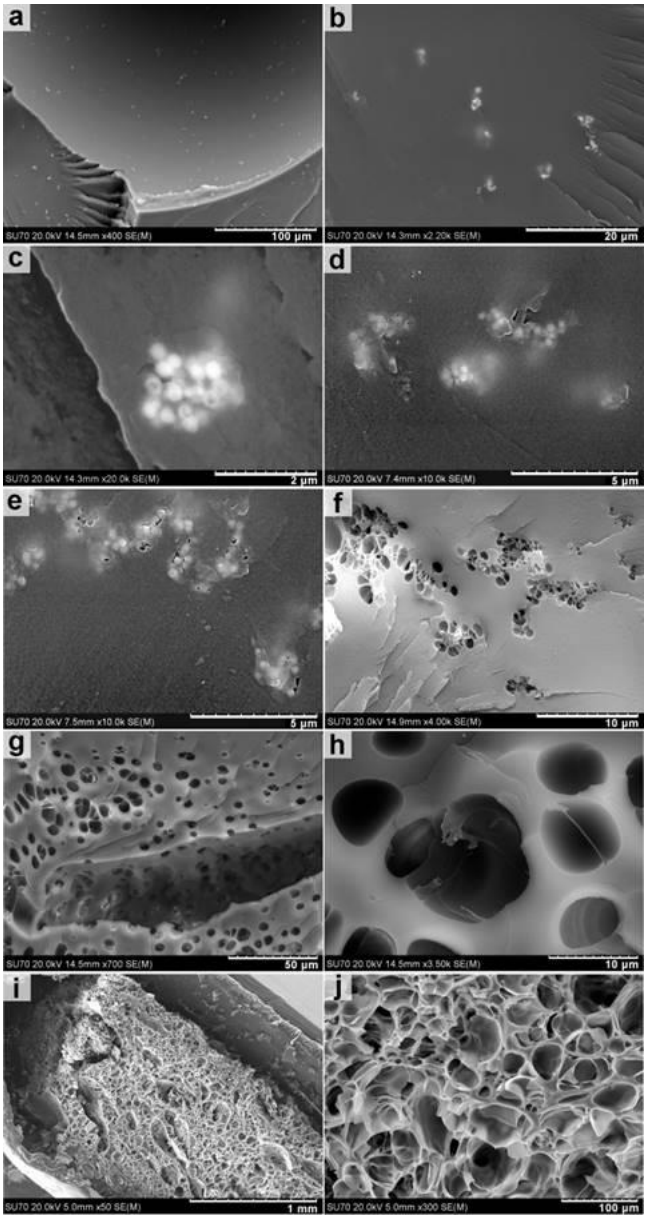

Figure 2: Field emission scanning electron microscopy (FESEM) images of the section fracture of the cured nanocomposite adhesive sheet without microwave irradiation (a-c), with single-mode microwave irradiation at 100W for 1(d), 1.5(f), 2.5 (g&h) and 3 (i&j) minutes.