New glue instantly hardens with electric current

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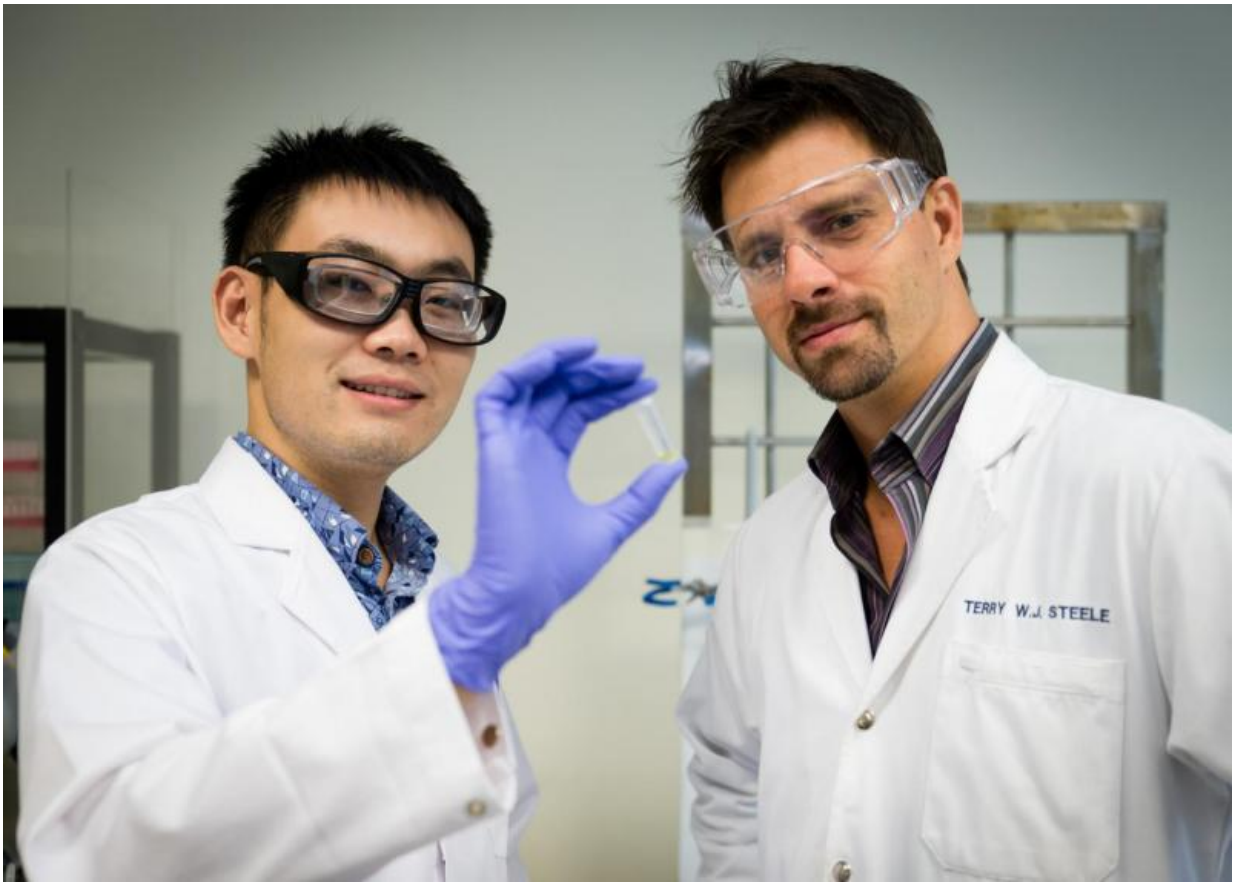

Dr Terry Steele (right) and his student Gao Feng have developed a glue that hardens in response to a small electric current. Credit: Nanyang Technological University

Researchers at Nanyang Technological University in Singapore believe the adhesive may be a game-changer in manufacturing fields as diverse as biological implants and automobiles.

The new adhesive is a liquid gel that "cures" to form a polymer bond when a voltage of less than two volts is passed through it. Curing is the amount of time it takes for a glue to reach full strength after it dries. The glue stops curing as soon as the current is turned off. Users can fine-tune the bond's strength and flexibility by varying the current's voltage and duration.

The bonding agent is a light, low-viscosity flowing liquid that allows users to coat and exactly position the materials to be joined. Applying voltage to the gel then rapidly cures it to a strong bond with high elasticity and high shear strength.

Currently available quick-curing adhesives used in industry are activated by light, heat or chemical catalysts, each of which limits uses to particular materials and appropriate environments. Light-activated adhesives, for example, are only suited to materials that are somewhat transparent, while thermosetting can only be used with components that can tolerate heat.

Such quick-curing adhesives are used widely in the manufacture of medical devices, automobiles and other consumer goods, where they are favoured over more labour-intensive, heavier mechanical fasteners such as rivets, screws or bolts, which weaken the materials to be fixed. However, there has been little innovation in the field for decades.

Potential uses for electro-cured adhesives include biological devices for which photo- or thermo-setting glues are problematic, such as bioelectronics or polymer electronics designed for attachment to living tissue. The adhesive can be tuned to handle certain vibration frequencies

or to match the firmness and flexibility of the soft tissue to which it will be attached.

In addition to biomedical uses, the new adhesive could make automotive assembly lines more efficient, since photo- and thermo-setting glues require costly, high-maintenance hardware.

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