Electrically charged glue invented for underwater use

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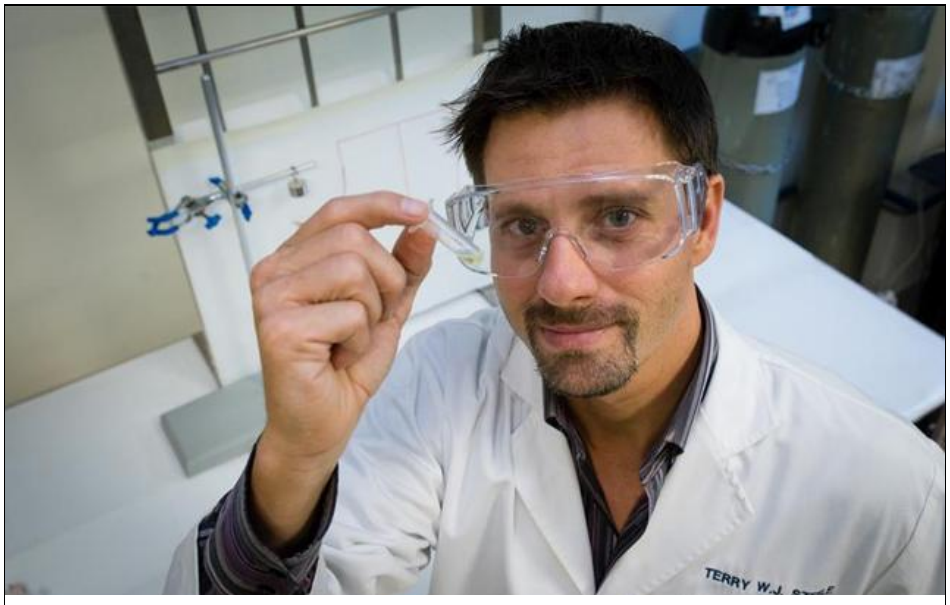

NTU assistant professor Terry Steele, lead scientist on the Voltaglue project

Scientists from Nanyang Technological University, Singapore, have invented a glue that hardens when an electrical voltage is applied to it. This enables the glue to be used successfully in wet environments, such as under water.

The new adhesive, nicknamed 'Voltaglue', opens up a host of practical applications, from permanent underwater repairs on ships and pipes, to a temporary glue for doctors to use during surgery, holding together pieces of internal body tissue or skin as an alternative to more complex stitched sutures.

Adhesives such as superglue harden upon contact with moisture in the air. Others like epoxy, often used in electronic mobile devices, have to be baked at a heat of around 150 degrees Celsius or made using two different chemicals mixed together. These methods are unsuitable for wet environments and the results are often not acceptable.

Assistant Professor Terry Steele, the lead scientist for the research project from NTU's School of Materials Science and Engineering, said it took them over a year to develop an adhesive that could work under wet conditions, such as in the human body or underwater.

"Most glues in the market don't work under wet conditions, much like how sticky tapes won't work if the surface is wet, since the adhesive will stick to the water instead of the surface," Steele says.

"We had to find a way to make glue which cures [hardens] when we want it without being affected by the environmental conditions, so electricity was the best approach for us. The hardness of our glue can be adjusted by the amount of time we apply a voltage to it, which we call electrocuring."

This unique electrocuring property allows Voltaglue to be customised for different applications.

"For example, if we are gluing metal panels underwater, we want it hard enough to stick for a long time. However, for medical applications, we want the glue to be more rubber-like so it wouldn't cause any damage to the surrounding soft tissues," Steele explains.

Voltaglue is developed using hydrogels consisting of carbon molecules called carbenes grafted onto tree-shaped plastic known as dendrimers. Upon contact with electricity, the reactive carbenes, which are capable of hooking onto any surface nearby, are released. The amount of hooks created depends on how long electricity is applied and how many carbenes are present.

Another distinct feature of the new glue is that it could be made reversible, Steele says.

This technology is currently patented through NTUitive, the university's commercialisation arm.