future focus

Science fact has taken another step towards the world of science fiction, with the recent development of plastics that can heal themselves when damaged. Paul Rincon reports on the polymers that mimic one of the miracles of life

You're driving as fast as the speed limit will allow. Your pulse is racing and all you can think about is getting home. Then panic – you're gripped with fear and confusion as your car spins out of control. Most motorists dread the prospect of a tyre blowout, but it's a scenario that could soon be consigned to history. The discovery of a plastic that can heal itself like skin could pave the way for tyres that don't wear out, PCs that repair themselves and tennis rackets that hardly ever need to be replaced.

The discovery by US scientists of a plastic that can heal itself like skin could pave the way for tyres that don't wear out, PCs that repair themselves and tennis rackets that hardly ever need to be replaced

Special assignment

While many scientific discoveries occur by accident, Professor Scott White of the University of Illinois at Urbana-Champaign says he always had a clear aim: to create an artificial polymer that could mimic the regenerative powers of the human body. "It was one of those rare occasions where we sat down and decided to do something," he says of the project's beginnings. White soon realised that it was never going to be easy: "We had many failures along the way."

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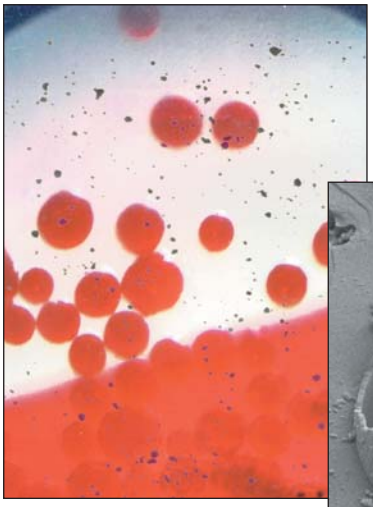
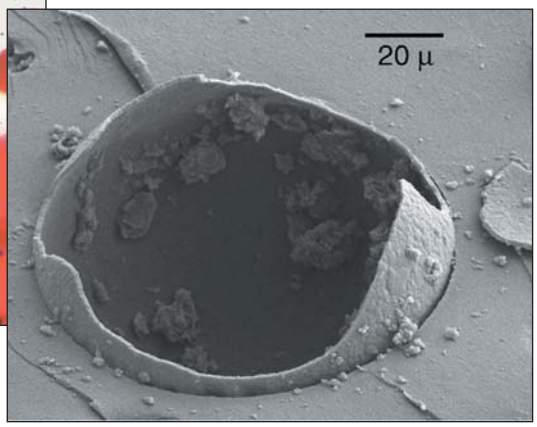


← This microscope image shows the self-healing plastic in action. The red circles are the microcapsules filled with the healing agent (dyed red for visualisation)



→ The ruptured microcapsule sits on the fracture surface of the plastic

In February 01, the aeronautical and astronautical engineering team announced a breakthrough. They had created a polymer embedded with microcapsules containing a chemical agent called dicyclopentadiene. When the plastic is damaged, the capsules in the area of the breakage release a liquid agent which comes into contact with a powdery catalyst. This catalyst causes the dicyclopentadiene to coagulate and harden, sealing the crack. The healed area regains 90 percent of its original strength. The process, which takes 24 hours to complete, resembles the way blood cells clot in a wound.

Regenerating interest

Needless to say, White is being courted by companies keen to exploit his discovery – among them Motorola and Boeing. Most of the interest so far concerns the use of the material in microelectronics. "Circuit boards [in electronic equipment] are constantly heating up and cooling down, which causes them to crack," says White. If circuitry could heal these cracks, laptops and PCs would become more durable and need less maintenance. White has also been contacted by tyre manufacturers, the aerospace industry and biomedical firms. In the last case, it has been speculated that the plastic could be used in hip replacements and even dental fillings.

However, these companies are keeping their interest strictly under wraps. "They [the companies] don't want anyone to know, because if you're interested in a material that heals itself, it implies you make things that break," White chuckles.

Shaping up for the future

White's invention may solve myriad problems, but it still has limitations. For example, after the microcapsules run out, the plastic loses its regenerative properties. And although the polymer is ideal for repairing breaks, it can't reform complex shapes. "If you're flying a fighter jet and you get hit by a missile, this won't fix anything," says White.

White is now working with a team of researchers at the University of Connecticut who are investigating plastics that have an unusual property known as shape memory. The aim is to marry up both sets of research and create a revolutionary plastic that, no matter how badly damaged it is, remembers its original shape as it heals. ■