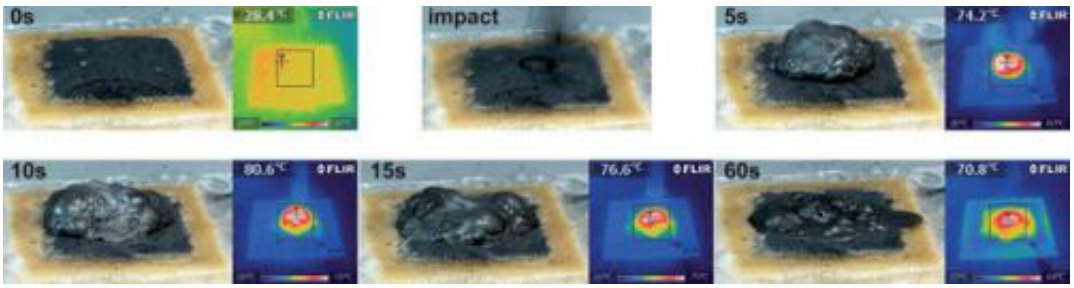
Chemists mimic bombardier beetles to safeguard ATMs

March 27 2014, by Bob Yirka



Credit: J G Halter et al, J. Mater. Chem. A, 2014, DOI: 10.1039/c3ta15326f

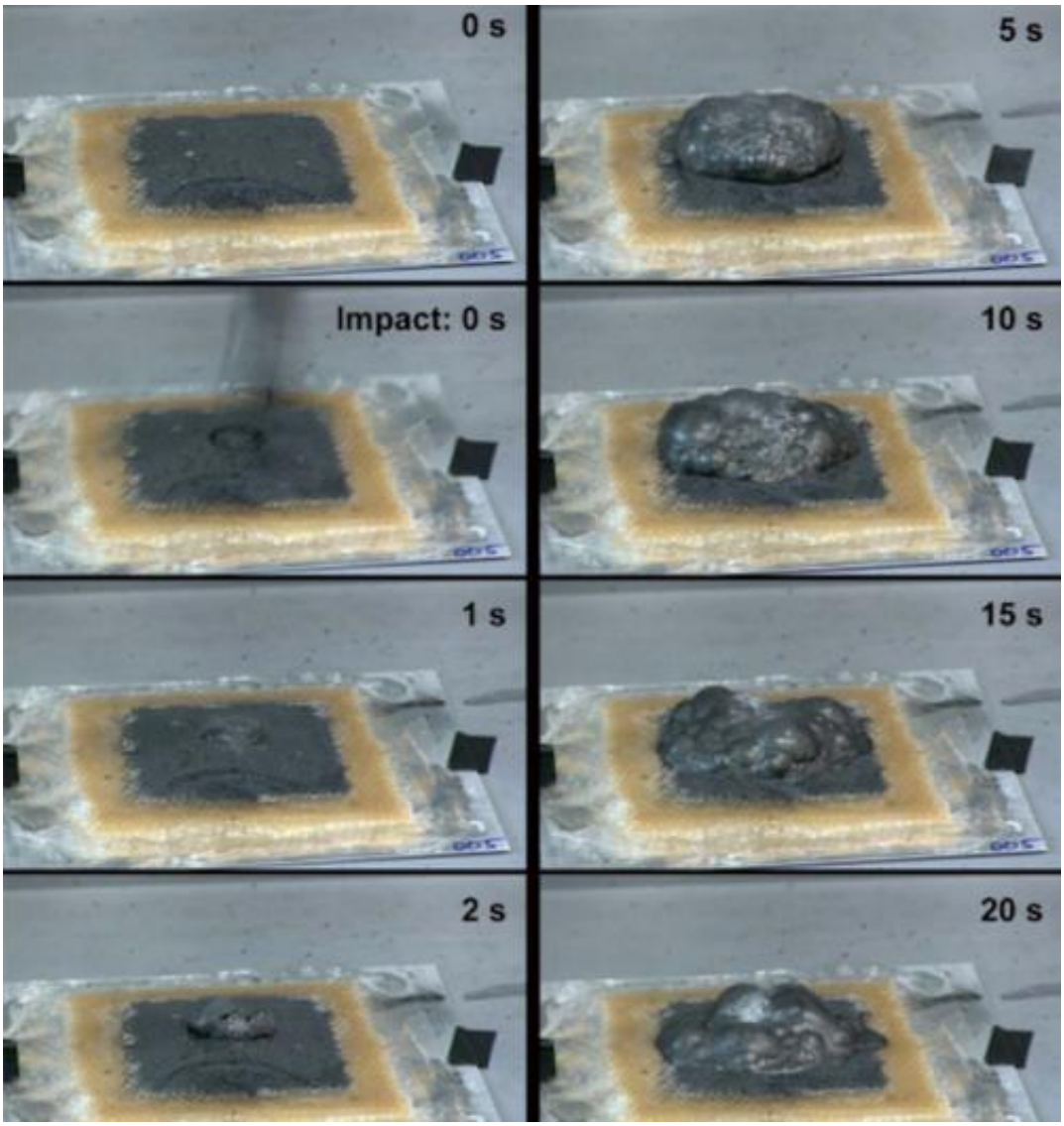
(Phys.org) —A team of chemists in Switzerland has developed a new way to protect cash inside of ATM machines from thieves—by automatically setting off a nasty chemical reaction if the machine is molested. The group has published a paper in *Journal of Materials Chemistry A* describing their idea and how it might work.

As the team describes it, their idea was inspired by the bombardier beetle which releases a hot nasty chemical when bitten by a predator. The chemical reaction comes about due to the release of an enzyme that mixes with hydrogen peroxide held inside the beetle's body. Instead of releasing an enzyme, the system envisioned by the team in Switzerland relies on a thin membrane being broken by would-be thieves.

Inside the ATM there would be two pouches, one filled with hydrogen

peroxide the other with manganese oxide. The two pouches would be separated by a thin membrane that would be easily broken if someone were to try to access the cash also held inside the ATM. That would allow the two chemicals to come into contact with each other, instigating the reaction. The result would be the generation of a foam that could conceivably destroy the paper currency it was designed to protect. If thieves learned that their efforts only ever led to cash destruction, they would cease trying to steal ATMs and break into them—thus no security guards or other measures would need to be taken to protect the cash they hold, dramatically lowering ATM security protection costs.

In other scenarios, the chemical reaction could be made to cause a burst of steam that would douse robbers with easily identifiable chemicals or a dye to aid in identifying them later. Cash could also be marked instead of destroyed, making it difficult for thieves to use it. Other possibilities might include modifying the membrane to break when bent rather than when broken to ensure the reaction takes place.



Credit: J G Halter et al, J. Mater. Chem. A, 2014, DOI: 10.1039/c3ta15326f

The researchers suggest that their system could also be modified for use in other applications as well, such as inside medical implants (certain conditions would lead to the automatic release of drug perhaps) or as a pest deterrent on crops. The same team has also been responsible for the development of other novel technology, such as "sweaty buildings" to help reduce cooling costs. Thus it appears worth watching to see what they come up with next.

More information: Self-defending anti-vandalism surfaces based on mechanically triggered mixing of reactants in polymer foils, *J. Mater. Chem. A*, 2014, Accepted Manuscript. DOI: 10.1039/C3TA15326F . pubs.rsc.org/en/content/articl … a15326f#!divAbstract

Abstract

The bombardier beetle uses attack-triggered mixing of reactants (hydrochinone, hydrogen peroxide H2O2 and enzymes as catalysts) to defend itself against predators. Using multi-layer polymer sheets with H2O2 and catalyst (MnO2) filled compartments we developed a 2D analogous bio-inspired chemical defence mechanism for anti-vandalism applications. The reactants were separated by a brittle layer that ruptures upon mechanical attack, and converts the mechanical energy trigger (usually a few Joules) into a chemical self-defence reaction involving release of steam, and optionally persistent dyes and a DNA-based marker for forensics. These surfaces effectively translate a weak mechanical trigger into an energetic chemical reaction with energy amplification of several orders of magnitude. Since the responsive materials presented here do not depend on electricity, they may provide a cost effective alternative to currently used safety systems in the public domain, automatic teller machines and protection of money transport systems. Anti-feeding protection in forestry or agriculture may similarly profit from such mechanically triggered chemical self-defending polymer surfaces.

Citation: Chemists mimic bombardier beetles to safeguard ATMs (2014, March 27) retrieved 19 April 2024 from https://phys.org/news/2014-03-chemists-mimic-bombardier-beetles-safeguard.html