The perfect Christmas gift? A nanoscale snowman

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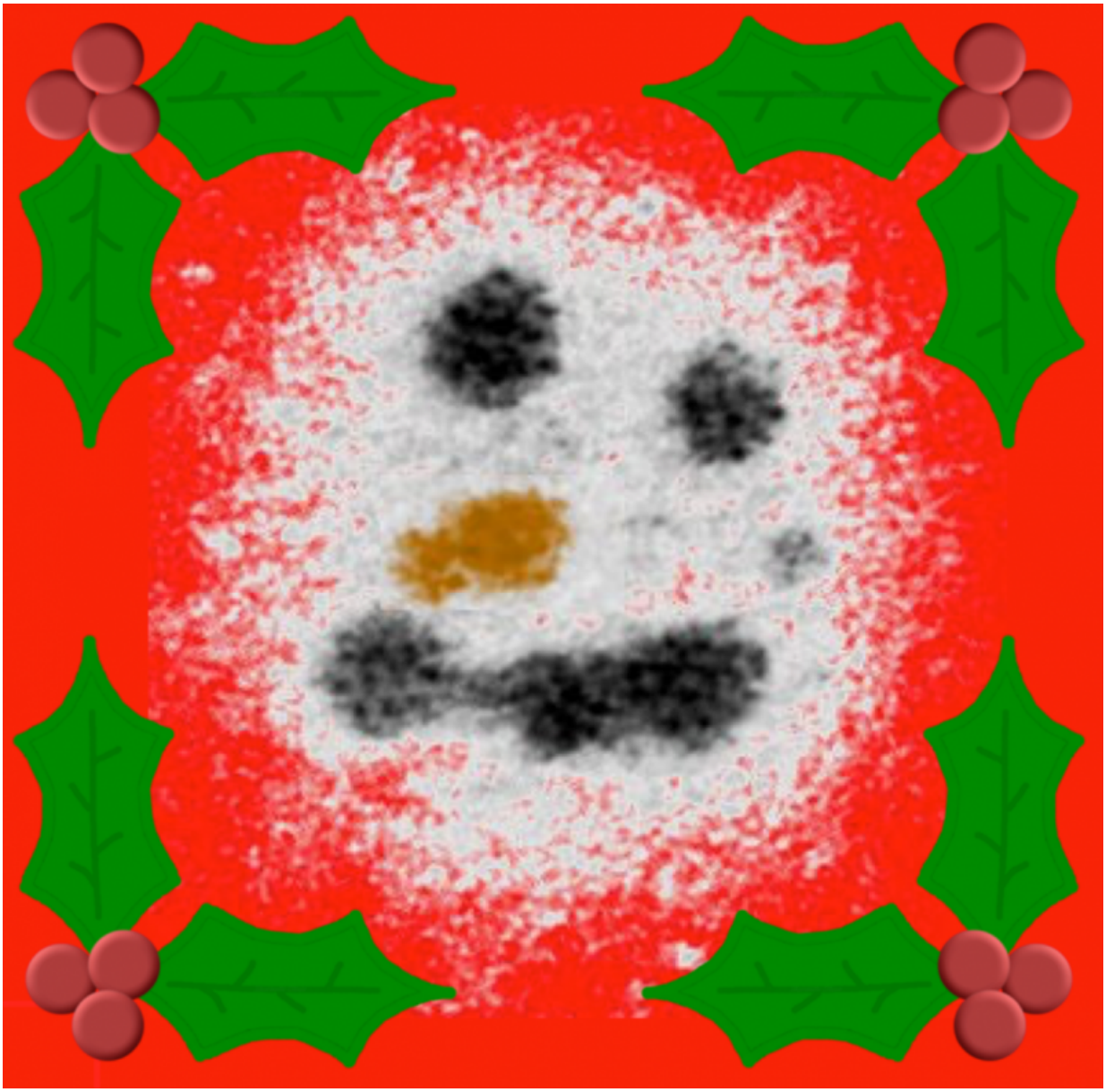

Would a jewel-encrusted snowman make the perfect Christmas present? At only 5 nanometres in size, the price might be lower than you think. And it's functional too, catalysing the splitting of water to make green hydrogen for fuel cells.

The nanoparticle, as imaged with the aberration-corrected scanning transmission electron microscopes, features eyes, nose and mouth of precious-metal platinum clusters embedded in a titanium dioxide face. Each platinum cluster typically contains 30 platinum atoms; within the whole nanoparticle there are approximately 1680 titanium atoms and 180 platinum atoms.

The nano-snowman formed spontaneously from a self-assembled platinum-titanium nanoparticle which was oxidised in air, drawing the titanium atoms out to the surface. The self-assembly occurred in a gas phase, cluster beam condensation source, before size-selection with a mass spectrometer and deposition onto a carbon surface for oxidation and then imaging. The mass of the snowman was 120,000 atomic mass units. Compared with a more conventional pure platinum catalyst particle, the inclusion of the titanium atoms offers two potential benefits: dilution of how much precious platinum is needed to perform the catalysis, and protection of the platinum cores against sintering (i.e. aggregation of the nanoparticles). The shell is porous enough to allow hydrogen through and the particles are functional in the hydrogen evolution reaction.

The research was performed at the Nanoscale Physics Research Lab in Birmingham, UK, by Caroline Blackmore, Ross Griffin and Richard Palmer.

Provided by University of Birmingham

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