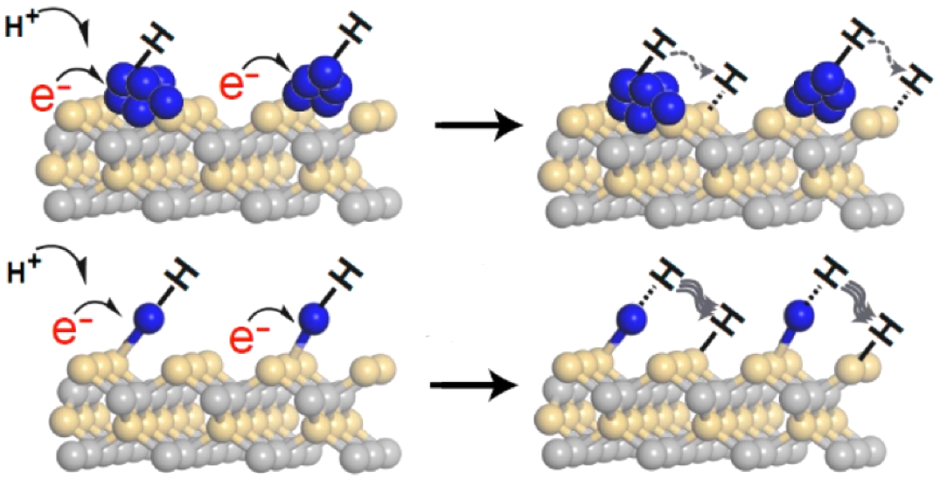
Single Atoms Break Carbon's Strongest Bond



The image shows a direct comparison of the mechanisms of a Pt nanoparticle catalyst (upper row) and a single-atom Pt catalyst (lower row). The single-atom is more active because the hydrogen is only weakly bound and therefore can easily 'spill over' onto the SiC surface.

Scientific Achievement

Scientists developed a new catalyst using single atoms of platinum for breaking carbon-fluorine bonds.

Significance and Impact

This challenging reaction is important in both chemical synthesis and environmental remediation of recalcitrant fluorinated hydrocarbons.

Research Details

- Pt was loaded as single atoms on silicon carbide (SiC) using a facile, scalable, wet-chemical method developed based on anchor-site and photoreduction techniques.
- Extended X-ray Absorption Fine Structure (EXAFS) and X-ray Absorption Near Edge Structure (XANES) at NSLS-II's ISS beamline 8-ID were used to visualize Pt atoms in the catalyst.
- High catalytic activity is attributed to an effective hydrogen spillover from isolated Pt atoms onto the SiC surface.

D. Huang, G. A. de Vera, C. Chu, Q. Zhu, E. Stavitski, J. Mao, H. Xin, J. A. Spies, C. A. Schmuttenmaer, J. Niu, G. L. Haller, J. H. Kim. *ACS Catalysis* 8 (10), 9353-9358 (2018)

Work was performed in part at Brookhaven National Laboratory