New strategy improves stability of platinum group metal catalysts

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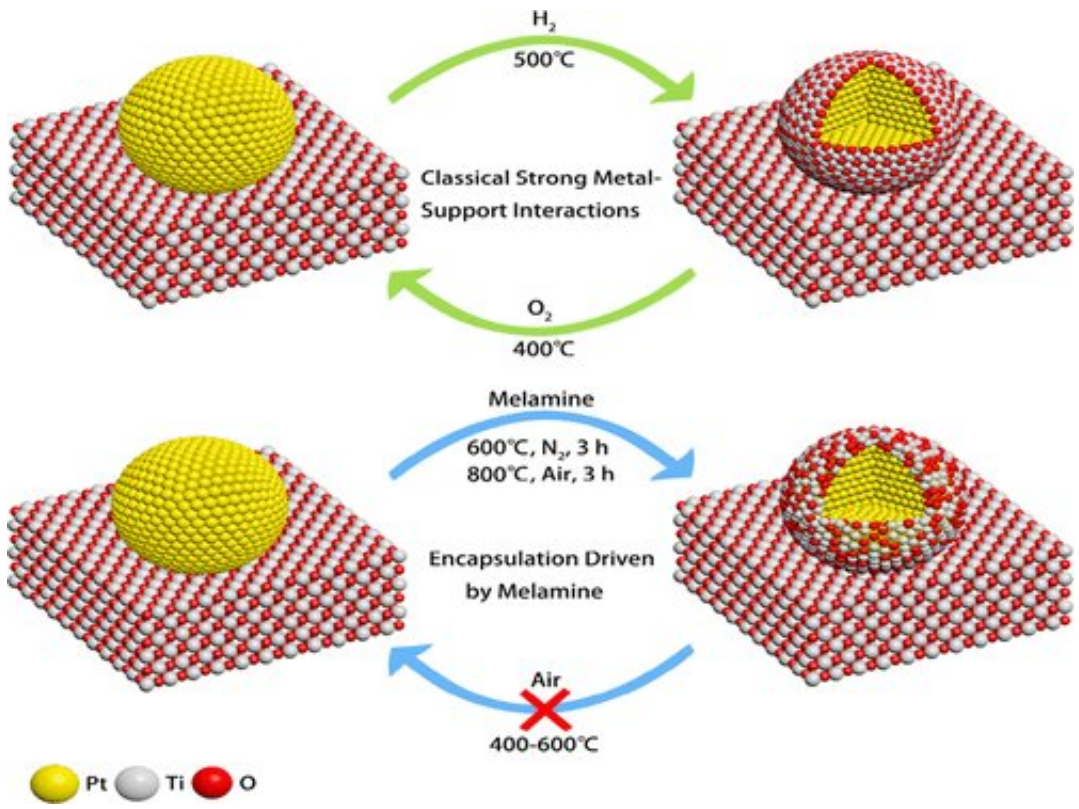

Credit: ACS

Recently, a group led by Prof. WANG Junhu from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) constructed a novel type of strong metal-support interaction (SMSI) through the melamine/urea catalyst modification and oxidation atmosphere calcination, and developed a new strategy to improve the

stability of platinum group metals (PGMs) catalysts.

This study was published in *ACS Catalysis* on May 4.

Prof. AO Zhimin from the Guangdong University of Technology and Prof. ZHANG Binsen from the Institute of Metals of CAS were also involved in the study.

The induced overlayer of SMSI often covers several catalytic active sites, leading to catalysts inactive in a degree. Moreover, the retreat of the overlayer upon reverse atmosphere treatment curtails the effect of SMSI on enhancing the catalytic performance of underlying metals, especially at elevated temperatures.

The classical SMSI induced by reduction atmosphere calcination between transition metal oxides and PGMs has been investigated. However, the encapsulation on the same catalysts occurred under oxidation condition is still unclear.

The researchers found the evidence that PGMs nanoparticles could be encapsulated by an amorphous and permeable TiOx cover layer on titania-supported catalysts under oxidative atmosphere driven by melamine/urea. It was contrary to the condition needed for classical SMSI between Pt and TiO_2.

Moreover, the formed overlayer was stabilized against re-oxidation at 400-600 °C in air, in sharp contrast to the retreat of TiOx overlayer by subsequent oxidation treatment in classical SMSI. And the formation mechanism of this kind of encapsulation was different from that of classical SMSI.

"The new strategy was further demonstrated on titania-supported Pd and Rh nanoparticles, and it provides a promising new way for designing

supported PGMs-based catalysts with high activity and stability," said Prof. WANG.

More information: Shaofeng Liu et al. Encapsulation of Platinum by Titania under an Oxidative Atmosphere: Contrary to Classical Strong Metal–Support Interactions, *ACS Catalysis* (2021). DOI: 10.1021/acscatal.1c01347

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