Nature of five-coordinated aluminum on γ-Al2O3 surface

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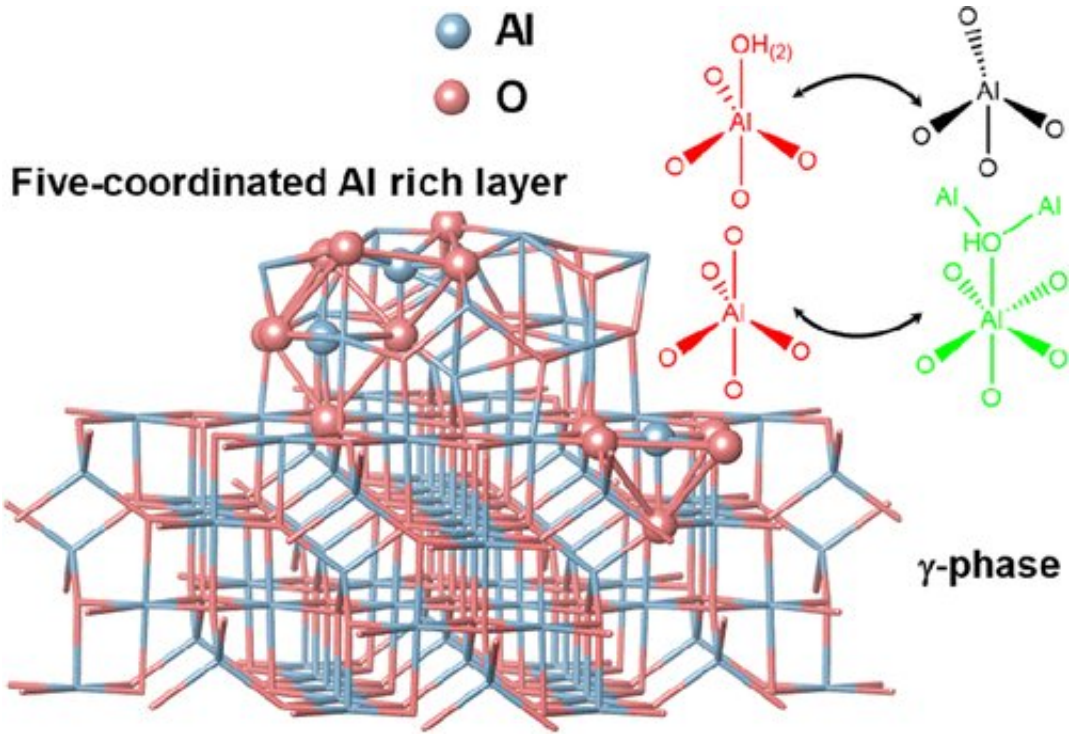

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γ-Al_2O_3, an important catalyst and catalyst support, is widely used in various industrial applications. The five-coordinated aluminum, or Al(V), on the surface of γ-Al_2O_3 can affect the catalytic performances of γ-Al_2O_3.

Recently, a research team led by Prof. Hou Guangjin from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS), in collaboration with Dr. Gan Zhehong from the National High Magnetic Field Laboratory, for the first time observed the structure of Al(V) on the surface of γ-Al_2O_3 using ultrahigh-field (1.5GHz) solid-state Nuclear Magnetic Resonance (NMR) spectroscopy.

This study was published in *ACS Central Science* on May 23.

The researchers investigated the structural properties of commercial γ-Al_2O_3 and amorphous alumina nanosheets (Al_2O_3-NS) rich in Al(V) by ultrahigh-field multinuclear and multi-dimensional Magic Angle Spinning (MAS) NMR.

They analyzed the aluminum species in both aluminas and found the flexible structural features on the surface of Al_2O_3-NS. And they demonstrated the hydroxyl groups on the surface of γ-Al_2O_3 with close spatial proximity that were able to be removed under high-temperature dehydration, resulting in surface structure reconstruction.

Moreover, by using ultrahigh-field ^{27}Al-^{27}Al double-quantum NMR, the researchers for the first time revealed that most Al(V) species tended to aggregate into Al(V) domains on the surface of γ-Al_2O_3 like Al_2O_3-NS, rather than tetragonal pyramid coordination on (100) surface previously predicted from theoretical models.

"These new insights into surface Al(V) species would help us to better understand the structure and function relationship of γ-Al_2O_3 when used as catalysts and catalyst supports," said Prof. Hou.

More information: Zhenchao Zhao et al, Nature of Five-Coordinated Al in γ-Al2O3 Revealed by Ultra-High-Field Solid-State NMR, *ACS Central Science* (2022). DOI: 10.1021/acscentsci.1c01497

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