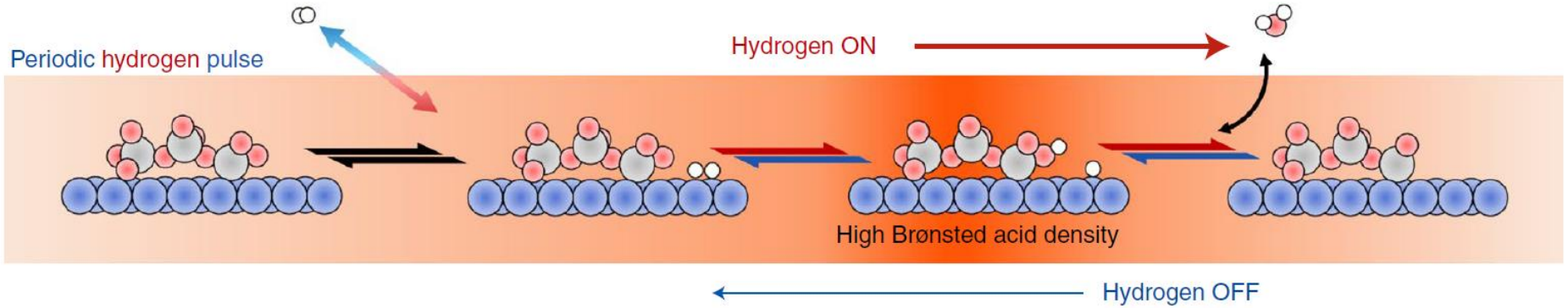
Pathway to a New Brønsted Acid Catalyst



The schematic shows how hydrogen pulses can sustain high Brønsted acid density

Scientific Achievement

Scientists demonstrated how the acidity on a catalyst can be modulated by changing the pretreatment conditions and by periodic hydrogen pulsing, causing a dramatic increase in the rate of the acid-catalyzed reaction.

Significance and Impact

Brønsted acid catalysts of oxide clusters on metal are efficient for petrochemical, fine chemical, pharmaceutical, and biomass upgrade reactions. This study offers new insights into active sites and how to tune these catalysts.

Research Details

- Synthesized the catalyst by atomic layer deposition.
- Used density functional theory and microkinetic modelling to predict the structure and dynamics for comparison with experimental studies.
- Demonstrated Brønsted acid catalysis under working conditions.
- Elucidated the structure and dynamics through X-ray studies at the QAS beamline at the NSLS-II, the 5-BM-D beamline at the APS and the CFN.

J. Fu, S. Liu, W. Zheng, R. Huang, C. Wang, A. Lawal, K. Alexopoulos, S. Liu, Y. Wang, K. Yu, J. A. Boscoboinik, Y. Liu, X. Liu, A. I. Frenkel, O. A. Abdelrahman, R. J. Gorte, S. Caratzoulas & D. G. Vlachos. *Nat Catal* **5**, 144–153 (2022).

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