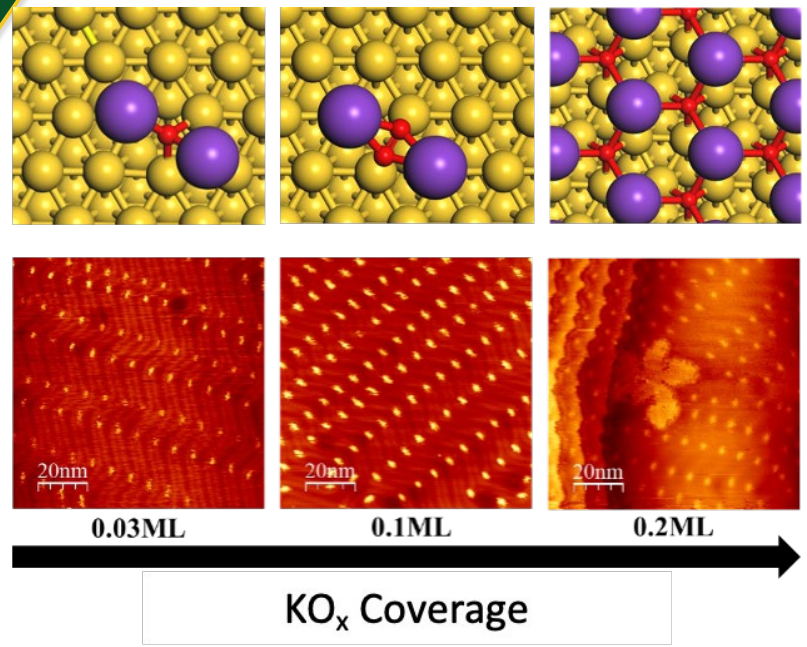
Multiple Growth Modes of Potassium Oxide on Au(111) and Their Intrinsic Catalytic Activity



STM images and DFT optimized structures for KO_x/Au(111) at different alkali coverages

Scientific Achievement

The high catalytic activity of small potassium oxide (KO_x) particles supported on Au(111) for the CO oxidation reaction was discovered and studied using a combination of scanning tunneling microscopy (STM), ambient-pressure X-ray photoelectron spectroscopy (AP-XPS), catalytic testing (CT), and density function theory (DFT).

Significance and Impact

Multiple growth modes were found for potassium oxide on Au(111). The study revealed a key correlation involving structure, oxidation state, and chemical activity for the alkali oxide under reaction, highlighting the importance of small aggregates of K_2O in catalysis beyond the role of plain promoters typically assigned in the literature.

Research Details

- STM and XPS studies revealed the morphologies and compositions of KO_x at different alkali coverage, going from clusters to islands.
- Batch reactor measurements showed high CO oxidation activity for the small KO_x clusters and a deactivation at high K coverage.
- DFT studies helped to explore the phase changes in KO_x and identified K_2O as the most active alkali species for CO oxidation.

R. Shi, W. Liao, P.J. Ramirez, I. Orozco, M. Mahapatra, J. Kang, A. Hunt, I. Waluyo, S.D. Senanayake, P. Liu, J.A. Rodriguez. *Angew. Chem. Int. Ed.* **2022**, DOI: 10.1002/anie.202208666

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