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The Curious Relationship of Sintering to Activity in Supported Gold Catalysts for the Hydrochlorination of Acetylene

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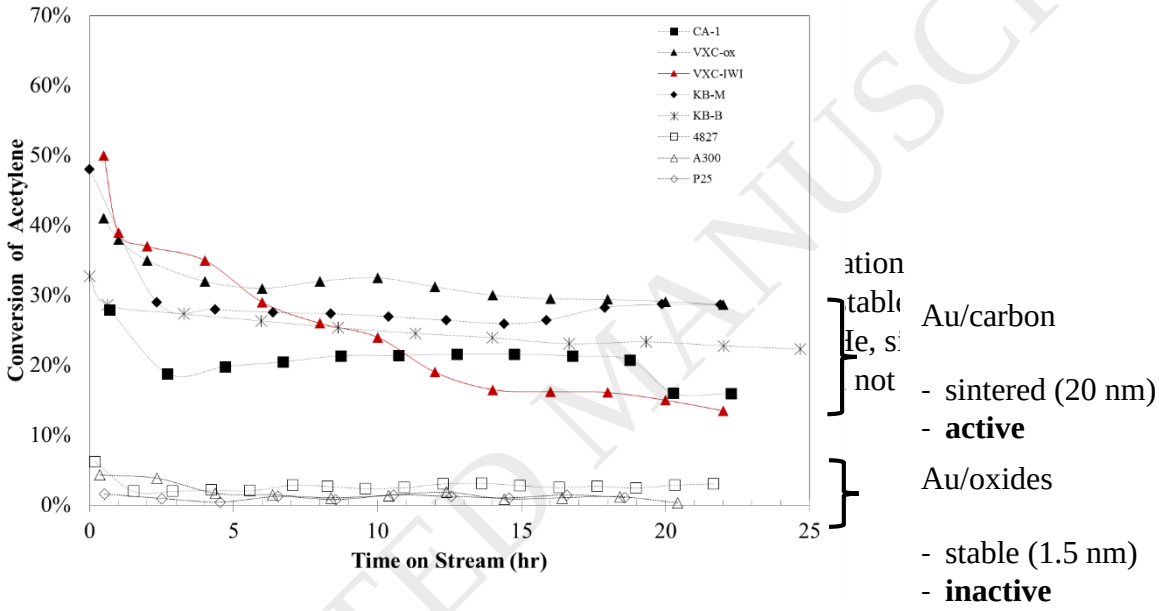
Graphical abstract



Gold catalysts for the hydrochlorination of acetylene are currently being studied as an environmentally benign replacement for industrial mercuric chloride catalysts, which undergo reduction and subsequent sublimation into the atmosphere. In this work the method of strong electrostatic adsorption was used with a cationic gold precursor to controllably deposit the gold precursors over a variety of activated carbon and metal oxide supports. The catalysts were characterized by XRD, STEM, and XPS before and after reaction or aging at temperature (180°C) in HCl.

The synthesis procedure resulted in highly dispersed Au nanoparticles (usually below the 1.5 nm limit of detection and some from 2-3 nm) over all supports. The series of catalysts exhibited an unusual relationship of sintering to activity; the catalysts which best anchored the Au crystallites were the least active; titania and silica catalysts showed almost no sintering and were virtually inactive, and even a graphitic carbon catalyst exhibited good anchoring but very poor activity. The