# CATALYTIC COMBUSTION OF $CH_3Br$: MECHANISM AND DRY SCRUBBING OF Br BYPRODUCTS

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**Abstract.** The overall purpose of this research is to develop technology for removing methyl bromide (MB) from QPS fumigation vent streams using catalytic air oxidation over ceria catalysts. Recent efforts have focused on understand the mechanism of catalytic air oxidation and practical ways to scrub bromine-containing byproducts from exit gases. The best catalyst tested so far (1%Pt/30%$CeO_2$-$Al_2O_3$) is efficient at temperatures as low as 400°C—far lower than non-catalytic combustion—and highly robust (no deactivation after 10 h of continuous use at 400°C). MB is quantitatively converted to $Br_2$ and HBr in a ratio that increases with temperature to a maximum of ~9:1 at 400°C. The results collectively can be interpreted mechanistically in terms of conversion of MB to $CO_2$, $H_2O$ and HBr, followed by catalytic oxidation of HBr to $Br_2$ (Scheme). X-ray photoelectron spectroscopy (XPS) shows that bromide builds up on the catalyst surface at temperatures cooler than 400°C, but with increasing temperature bromide burns off as $Br_2$ and Ce(III) concentration increases due to participation of Ce(IV) on the catalyst surface in HBr oxidation. Both HBr and $Br_2$ are efficiently scrubbed from the catalytic reactor effluent gas by passing it through a cartridge containing a solid-phase reducing agent (e.g., sodium thiosulfate) and a base (e.g., $Ca(OH)_2$ or $Zr(OH)_4$). Catalytic oxidation by ceria-based catalysts appears to be a promising approach for eliminating MB from QPS fumigation vent streams.