

# Tailored synthesis of thin oxide films for catalytic combustion

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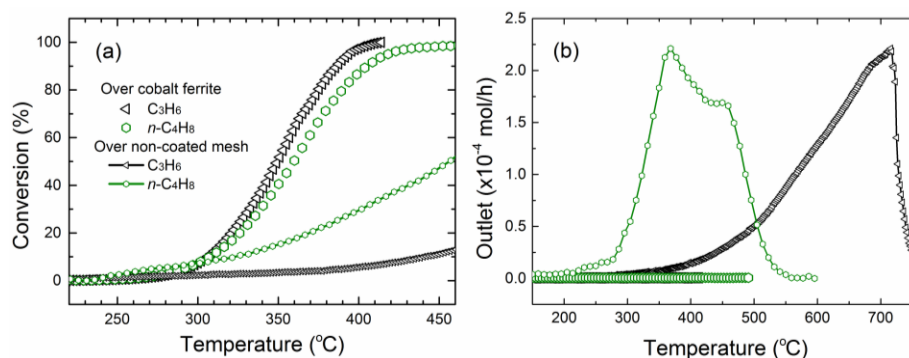
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Catalytic combustion has been generally recognized as one of the most efficient and promising techniques for the abatement of volatile organic compounds (VOCs) and deep oxidation of different fuels and exhaust emissions. Due to their low cost and good performance, transition metal oxides especially binary oxides have become suitable alternatives as catalysts for deep oxidation applications. In recent years, transition metal oxides (TMOs) especially binary oxides with bifunctional properties have become suitable alternatives as heterogeneous catalysts for industrial applications. This work will introduce facile synthesis of binary cobalt ferrite oxide as a representative for low-temperature combustion of propene ( $C_3H_6$ ) and *n*-butene (*n*- $C_4H_8$ ).

In the present work, cobalt ferrite oxide was synthesized by pulsed-spray evaporation chemical vapor deposition. To better understand the structure-performance relationship, the prepared thin films were characterized in terms of variable physicochemical properties. An in-situ emission FTIR spectroscopy and DRIFTS were employed to investigate the redox properties of the prepared cobalt ferrite oxide and surface reactions, respectively. The catalytic performance of the cobalt ferrite oxide was evaluated against oxidation of  $C_3H_6$  and *n*- $C_4H_8$  with a fixed bed quartz reactor-FTIR system.

XRD patterns and Raman reveal that binary cobalt ferrite oxides could be facilely synthesized. The catalytic tests display that the involvement of cobalt ferrite oxides can initiate  $C_3H_6$  and *n*- $C_4H_8$  oxidation at lower temperatures, as shown in Fig. 1. Compared to the reactions on non-coated mesh for a specific reactant gas, cobalt ferrite tends to prohibit the formation of CO. The attractive performance of cobalt ferrite oxides is attributed to a redox mechanism which involves the synergistic effect of the reducibility and lattice oxygen mobility. The results indicate that cobalt ferrite oxides prepared via facile and inexpensive method have the potential applications in the abatement of VOCs and exhaust emissions.



**Fig. 1**  $C_3H_6$  and *n*- $C_4H_8$  oxidation over cobalt ferrite and non-coated mesh: (a) fuel conversion; (b) CO production during the oxidation processes.

## References

- (1) Tian, Z.Y.; Tchoua Ngamou, P.H.; Vannier, V.; Kohse-Höinghaus, K. *Appl. Catal. B: Environ.* **2012**, 117-118: 125-134.