In situ spectroscopic studies of methane catalytic combustion over Co, Ce, and Pd mixed oxides deposited on a steel surface

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The study deals with the mechanism of methane catalytic combustion over structured cobalt catalysts. The aim of this study was to correlate the information of the catalyst surface intermediates during the methane combustion reaction investigated by in situ DRIFT spectroscopy and catalytic tests. The series of cobalt and cobalt palladium nanocomposite structured catalysts were obtained by impregnation method from nitrate solutions. Prior to the impregnation step, the kanthal steel carriers were precalcined at high temperature and deposited with the washcoat layer of γ-Al₂O₃. The catalyst surface was examined by XRF and in situ μRaman spectroscopy.

The in situ experiments performed under methane oxidative and non-oxidative conditions revealed that methoxy groups, formates/carbonates are active intermediates in methane catalytic combustion. The kinetic experiments also revealed that palladium doped cobalt catalyst can be considered as a good alternative for noble-based catalysts. Based on in situ experiments the mechanism of methane catalytic combustion over cobalt-palladium doped γ-Al₂O₃ was proposed (Fig. 1).

![Reaction mechanism of methane combustion over cobalt palladium-doped catalyst](image)

Fig. 1. Reaction mechanism of methane combustion over cobalt palladium-doped catalyst [1].

Keywords: methane combustion; in situ DRIFT; μRaman; reaction mechanism; wire gauze; cobalt oxide

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