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NO_x adsorption on K and Ba loaded on zirconia-titania NSR catalysts: A comparative study by *in situ* and *operando* IR spectroscopy

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Abstract

An intensive *in-situ* and *operando* IR study on NO_x adsorption over potassium (K) loaded zirconia-titania NSR catalyst in comparison to a barium (Ba) loaded one is reported. Based on *in situ* IR experiments, NO_x adsorption under heated environment was confirmed to favor potassium bidentate nitrate species rather than ionic nitrate species observed for Ba-loaded NSR catalyst (previously published). Complementary *operando* IR experiments revealed different mechanisms for NO_x adsorption over the two NO_x storage materials (NSMs): initial simultaneous NO₂⁻ and NO₃⁻ formation over K loaded catalyst while over Ba-loaded one, NO₂⁻ is first accumulated before being converted to NO₃⁻. Isotopic labelling in combination with *operando* experiments identified distinct dynamic behaviors regarding the exchange between nitrogen containing species on surface and in gas phase. This work provides beneficial inputs for advanced catalyst converter design, for example with zone-coated washcoat that contains more than one catalyst formulations.

Keywords: NSR, NO_x adsorption, Cation chemical hardness, Potassium, Zirconia-Titania, Barium

1. Introduction

The NO_x storage and reduction (NSR) or lean NO_x trap (LNT) has been a vital solution for Diesel or gasoline lean-burn engines as it can efficiently catalyse NO_x to harmless nitrogen [1–4]. The original and typical NSR catalytic formulation consists of platinum (Pt) and barium (Ba) supported onto alumina (γ -Al₂O₃) [1, 2]. Many studies have been performed providing

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