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NOx adsorption on K and Ba loaded on zirconia-titania NSR catalysts: A comparative study by insitu and operando IR spectroscopy

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Abstract

An intensive *in-situ* and *operando* IR study on NOx 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, NOx 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 NOx adsorption over the two NOx storage materials (NSMs): initial simultaneous NO_2^- and NO_3^- formation over K loaded catalyst while over Ba-loaded one, NO_2^- is first accumulated before being converted to NO_3^-. 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, NOx adsorption, Cation chemical hardness, Potassium, Zirconia-Titania, Barium

1. Introduction

The NOx storage and reduction (NSR) or lean NOx trap (LNT) has been a vital solution for Diesel or gasoline lean-burn engines as it can effeciently catalyse NOx to harmless nitrogen [1–4]. The original and typical NSR catalytic formulation consists of platinum (Pt) and barium (Ba) supported onto alumina ($\gamma - Al_2O_3$) [1, 2]. Many studies have been performed providing