**Hiden Reference: AP0316**
**Hiden Product: HPR-20 QIC TMS**

# Regeneration mechanism of Lean $NO_x$ Trap (LNT) catalyst in the presence of NO investigated using isotope labelling techniques

**N**$O_x$ **S**torage and **R**eduction (NSR) or **L**ean **N**$O_x$ **T**rap (LNT) catalysts are considered to be one of the most promising technologies for $NO_x$ removal from lean burn engine exhausts. In the NSR reaction $NO_x$ is stored under lean conditions and then reduced by $H_2$ or CO or hydrocarbons to $N_2$ during a short rich period. However, the reaction mechanism is not well-understood especially when using typical reaction conditions.

The current study highlights the effect of using NO in both lean and rich periods during the NSR reaction over a 1.2 wt% Pt/15 wt%Ba/$Al_2O_3$ catalyst. The transient kinetic switches, using $^{14}NO$ during the storage period and isotopically labelled $^{15}NO$ during the regeneration, allows us to analyse for nitrogen and ammonia formed from the reduction of stored nitrates. The evolution of gas phase species was monitored by a Hiden Analytical HPR-20 mass spectrometer. Three different routes are proposed for nitrogen formation based on the different masses detected during regeneration, i.e. $^{14}N_2$ (m/e=28), $^{14}N^{15}N$ (m/e=29) and $^{15}N_2$ (m/e=30) may take place. The formation of nitrogen via Route 1 involves the reaction between hydrogen and $^{14}NO_x$ to form mainly $^{14}NH_3$. Then, ammonia further reacts with $^{14}NO_x$ located downstream to form $^{14}N_2$. In Route 2 it is postulated that the incoming $^{15}NO$ reacts with hydrogen to form $^{15}NH_3$ in the reactor zone where the trap has been already regenerated. This isotopically labeled ammonia travels through the catalyst bed until it reaches the regeneration front where it participates in the reduction of stored nitrates ($^{14}NO_x$) to form $^{14}N^{15}N$. The formation of $^{15}N_2$ via Route 3 is believed to occur by the reaction between incoming $^{15}NO$ and $H_2$.

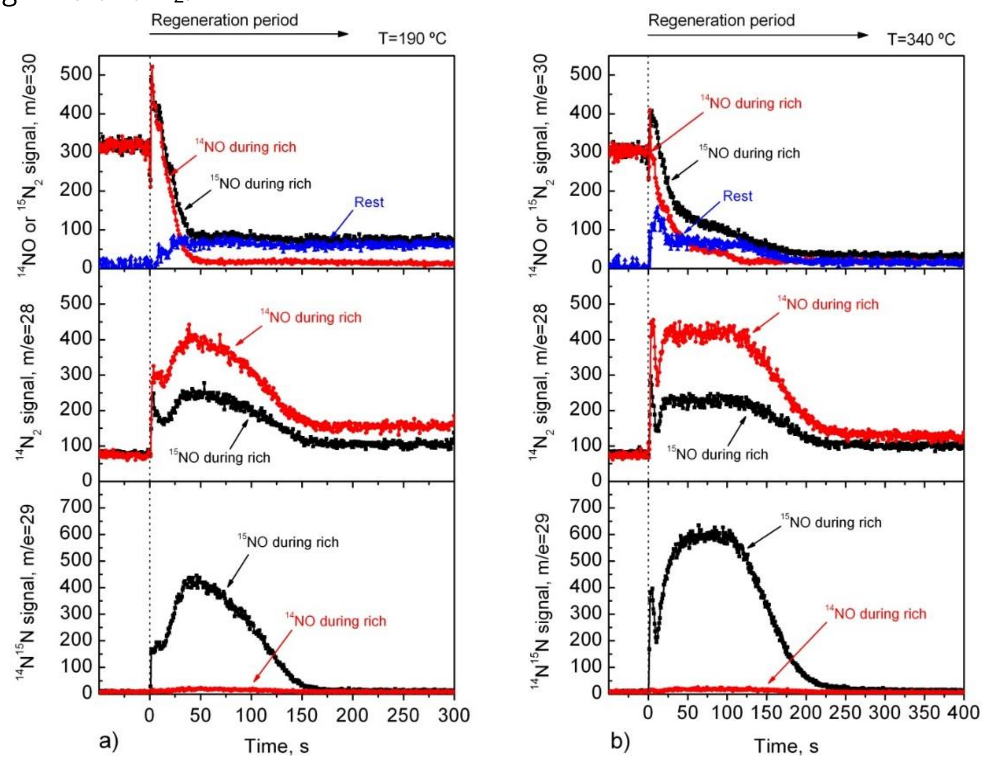


**Figure 1** Evolution of $^{15}N_2$ or $^{14}NO$ (m/e=30), $^{14}N_2$ (m/e=28) and $^{15}N^{14}N$ (m/e=29) during LNT regeneration, in the presence of $^{14}NO$ (red points) or $^{15}NO$ (black points). (a) 190 ºC; (b) 340 ºC.

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**Paper Reference:**
Beñat Pereda-Ayo et al. (2012) "Regeneration mechanism of a Lean $NO_x$ Trap (LNT) catalyst in the presence of NO investigated using isotope labelling techniques" *Journal of Catalysis* ***285*** *(1), 177-186*

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