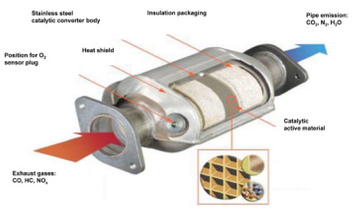
Case Study

Looking at Platinum Speciation in Three Way Catalysts



The Problem

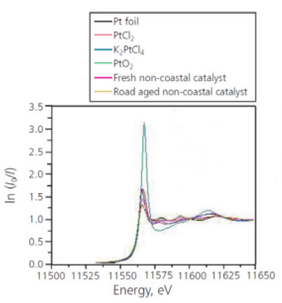
Platinum group metals play a crucial role in a variety of applications and in particular for a host of catalytic applications. The largest application is currently in vehicle emission control (VEC) catalysts to efficiently reduce particulate matter, CO, NO_x and hydrocarbons. This type of catalytic system is diverse and complex and generally contains 0.1-1 wt% active metal deposited on a thermally stable structural support. Therefore, applying a wide range of techniques is essential to fully understand these complex catalytic materials.

The Challenge

Characterisation of automotive exhaust catalysts has been carried out using a variety of analytical techniques before, during and after use. Most of these techniques need to be carried out under fixed, high vacuum conditions. This rules out the possibility of performing *in situ* studies on catalytic materials to mimic real industrial conditions. Therefore, the nature of the species present in the system under operating conditions are still not completely understood. More recently, there have also been concerns related to the theoretical possibility that toxic chloroplatinate species might exist in used catalysts under specific conditions.

The Solution

Scientists from Johnson Matthey have used beamline B18 at Diamond Light Source to carry out Pt L_3-edge X-ray Absorption Spectroscopy (XAS) measurements. The main goal of this experiment was to determine the types of species present in representative current technology of fresh and road aged diesel VEC catalysts, obtained from registered UK car dealers in both non-coastal and coastal regions. Detailed analysis of the XAS data revealed the presence of a mixture of oxidic and metallic species in the fresh catalysts. In the road aged catalyst the Platinum was metallic in nature.



The Benefits

X-ray Absorption Spectroscopy has provided very useful information about the oxidation state and the local structure of the studied element in the materials. Moreover, XAS studies can be employed in an *in situ* manner, this gives great potential for understanding the mechanism and behaviour of catalytic materials during activation and while catalytic reactions take place.

"We did this work on behalf of the International Platinum Group Metals Association (www.ipa-news.com) and were able to conclude that there were no Pt-Cl bonds present in the samples. Working with Diamond gave our scientists access to world class beamline facilities and staff"

Dr Peter Ash, Johnson Matthey Technology Centre

For further information please contact the Diamond Industrial Liaison Office on

+44 (0)1235 778797

industry@diamond.ac.uk

www.diamond.ac.uk/industry

@DiamondILO

International Platinum Group Metals Association

Johnson Matthey