UNDERSTANDING THE STRUCTURE AND PROPERTIES OF **CATALYSTS**

How advanced science, in this case synchrotron light, has helped researchers to better understand structures and properties of catalysts for the development of an improved industrial product.

The Danish multinational chemical company Haldor Topsøe specializes in the production and development of catalysts for the chemical, petroleum and fertilizer industries. Catalysts are substances that encourage chemical reactions without being consumed and are therefore very important materials for a wide range of industrial sectors.

For researchers from Haldor Topsøe to gain a better understanding of the structure and properties of catalysts they frequently visit the MAX IV Laboratory and DESY research facilities. One recent experiment at these facilities involved a catalyst used for the water-gas shift reaction:

$CO + H_2O <-> CO_2 + H_2$

This reaction is commonly used in the chemical industry to produce hydrogen (H_2) and is a first step in the production of the industrially important substances methanol (CH_3OH) and ammonia (NH_3). A common catalyst for the reaction is magnetite (Fe_3O_4) stabilized by chromium (Cr). Copper (Cu) is also often added to enhance the reaction.

To be able to improve the performance of catalysts it is important for the researchers from Haldor Topsøe to understand the structure of the material and how the different components interact. For this purpose they used synchrotron light in the X-ray absorption fine structure (XAFS) technique, which revealed important information about the material. The experiments showed how the nature of the Cu in the catalyst changed with varying conditions, this was valuable information in the company's development of improved industrial products.

Figure **NUMBER ONE**

Figure NUMBER TWO

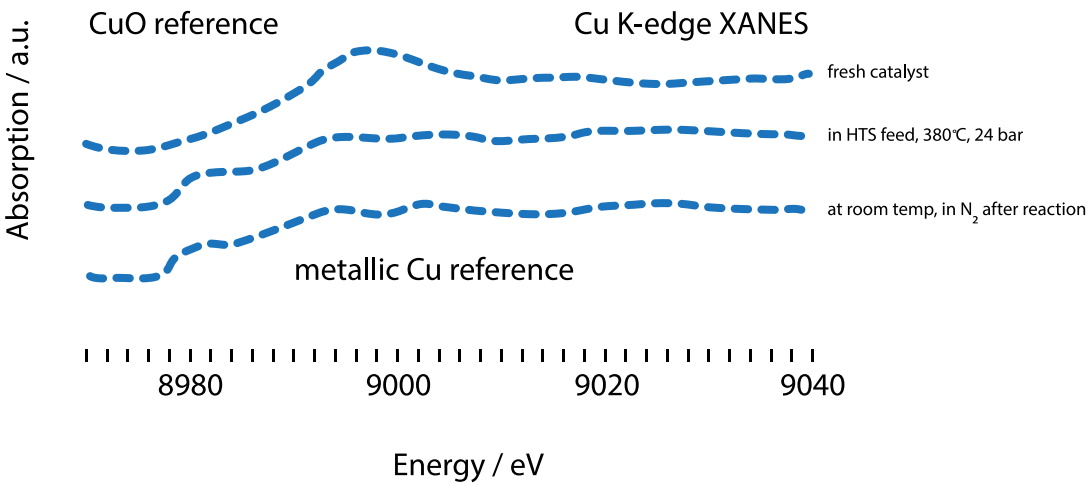

Figure 2 XAFS results from measurements on Cu promoted Cr stabilized Fe_3O_4 under various industrial conditions. Ref: Puig-Molina et al., J. Phys. Chem. C, Vol. 114, No. 36, 2010.

Science Link is a network between leading research facilities of photon and neutron sources and its users. The project aims to support and encourage innovation and entrepreneurship in the Baltic Sea Region. Apart from the research facilities, the network also includes scientific institutes, universities and regional organisations that serve as service and promoting units. Science Link is part-financed by the European Union (Baltic Sea Region Programme) and involves 20 partners from 9 countries during the project period 2012 to 2014.

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Research facilities

DESY
HZB Helmholtz Zentrum Berlin
Helmholtz-Zentrum Geesthacht
Centre for Materials and Coastal Research
MAX IV LABORATORY