	Experiment title: State of Pt nanoparticles during activation and in-situ dry reforming	**Experiment number**: CH2123
Beamline:	**Date of experiment**: from: 25/11/05 to: 29/11/05	**Date of report**:
Shifts:	**Local contact(s)**: Dr. Vivian NASSIF	*Received at ESRF:*

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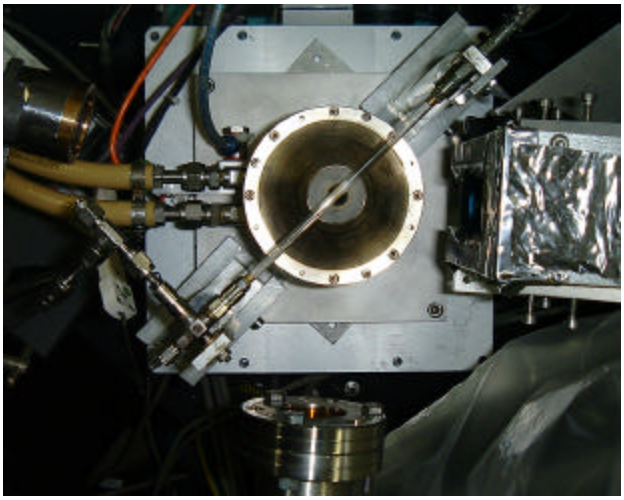
Report:

The objective of this experiment was the *in situ* study of the reactivity of noble metal nanoparticles supported on zirconia in the so called dry reforming reaction:

$$CH_4 + CO_2 \rightarrow 2\ CO + 2\ H_2$$

The reaction is performed at atmospheric pressure in the temperature range 700-800°C. The composition of the exhaust gases was checked with a Mass Spectrometer VG Prolab Thermo. This allows us to control on line the production of both CO and H_2 during the reaction and to evaluate the conversion of the reactants. The solid catalysts were composed of a small amount of Pt (from 0.1 up to 1 wt%) deposited on alumina, titania, zirconia or doped zirconia (with ceria or yttria). The platinum particles are highly dispersed at the surface of a refractory oxide.



The reactor is a capillary quartz tube containing the catalyst between two quartz wool plugs. Heat is produced by hot air from below the reactor as illustrated here (ESRF device). XAS spectra were recorded in fluorescence mode. The thickness of the capillary tube (2 mm), the seals with the expoxy glue, the pressure drop generated many troubles during the experiments. As compared to previous experiments performed at lower temperature (400°C) with the same kind of catalysts, the poor quality of the data can be attributed to the reactor and cell used.

Support effect in the dry reforming reaction is very important. It is assumed that basic suports stabilizes the catalysts by preventing coking. In our experiments, Pt on alumina catalyst was used and the in-situ analysis demonstrates, as reported in the literature, that a strong deactivation occurs as illustrated on Figure 1.

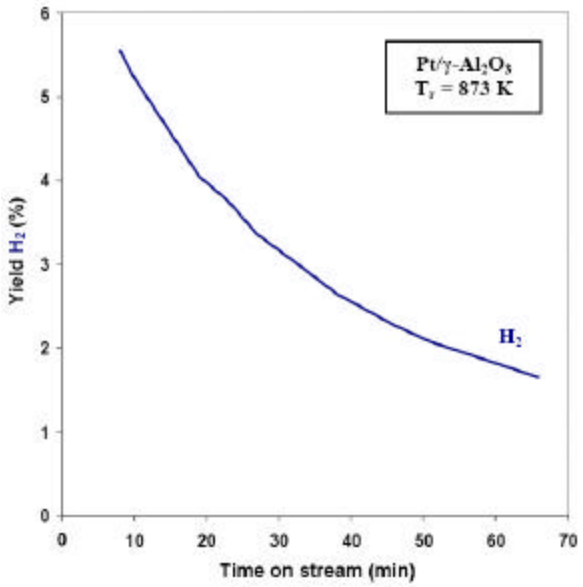


Figure 1. In situ deactivation of Pt/Al_2O_3 catalyst during dry reforming at 700°C.

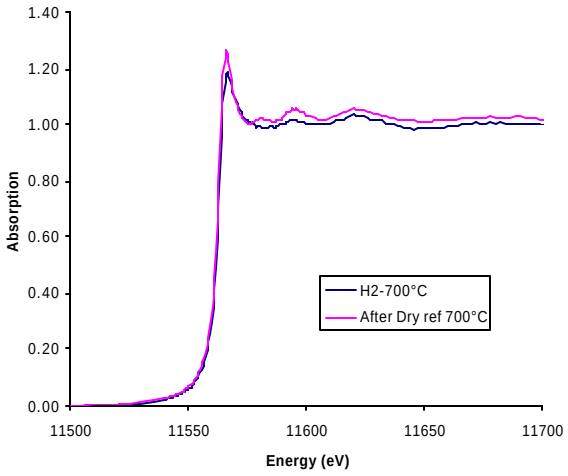


Figure 2. XANES spectra obtained at 700°C after reduction and after dry reforming reaction at 700°C

The analysis of the XANES demonstrates that deactivation is not only due to carbon deposit but also to the sintering of Pt particles revealed by a small contribution just after the edge.

The EXAFS data obtained were of poor quality and troubles due to the capillary tubes does not allows us to get more conclusions.