ROBL-CRG	**Experiment title:** Oxidation kinetics of polycristalline metal surfaces	**Experiment number**: 20_02_008
Beamline: BM 20	**Date of experiment**: from: Sept. 3th, 1998 to: Sept. 5th, 1998	**Date of report**: May 10th, 1999
Shifts: 8	**Local contact(s)**: N. Schell	*Received at ROBL:* *06.09.1999*

Names and affiliations of applicants (* indicates experimentalists):

* A. Knoll ENSAIS – LMCM 24, boulevard de la Victoire, F-67000 Strasbourg
A.Cornet ENSAIS – LMCM 24, boulevard de la Victoire, F-67000 Strasbourg
E. Smigiel ENSAIS – LMCM 24, boulevard de la Victoire, F-67000 Strasbourg
* Dr. F. Prokert, FZ-Rossendorf , FWIS
* Dr. N. Schell, CRG ROBL at ESRF, Grenoble and FZ- Rossendorf

Report

The oxidation behaviour of metals at elevated temperatures became of paramount importance, since it is of interest in many domains of material science and industrial engineering. It is now essential to control high temperature oxidation and therefore to investigate the kinetics of the growth of oxide films of the different material systems. Grazing X-Ray Reflectometry for exemple allows to determine the thicknesses of thin layers on a substrate by interference of the reflected X-Ray beam from several Ångstrom up to several hundred nanometers. In our experiments we investigated the oxidation behaviour of an polished XC15-steel samples to show the interest of this method. After isothermal heating of the samples the thicknesses of the oxide layers were determined in function of the heating time. This allowed to kinetics of oxide growth in function of heating temperature.

The oxidized samples were oxidized at 300°C in the laboratory LMCM at ENSAIS in Strasbourg. At ROBL, the samples were mounted on the goniometer and specular and diffuse reflectivity was measured under atmospheric pressure and room temperature. Figure 1 shows the specular reflectivity curve of the the XC15 steel samples in function of heating time. By simulation, we determined the oxide layer thickness in function of heating time and so the oxidation kinetics of the steel sample.(figure 2)

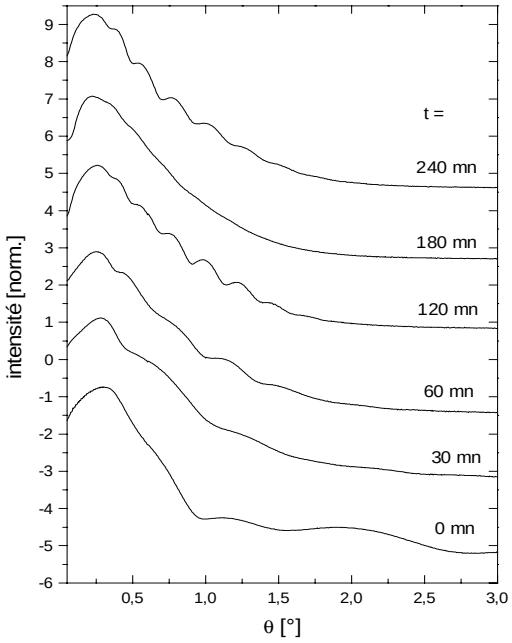

Fig 1. Reflectivity curves

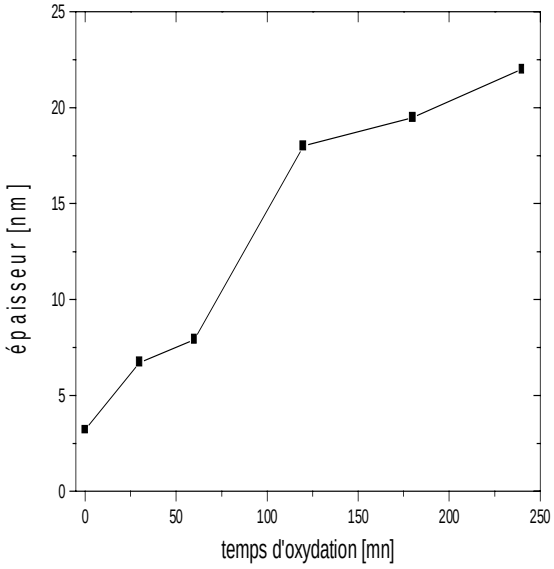

Fig 2. Oxidation kinetic

We observe in Figure 2 two different regions of oxidation behaviour. In the first zone a logarithmic growth can be observed. After a breakaway at about 70mn oxidation time, a parabolic growth behaviour can be observed. This two different zones correspond to two different oxidation behaviour. The breakaway is due to the change of the oxidation mechanism. This results could be reproduced on a laboratory X-ray source and confirmed the existing theories of high temperature oxidation of metals.

Diffuse reflectivity measurements results were compared to AFM measurements on the same samples and confirmed the experimental results obtained by diffuse XRR.