

Experiment Report

Proposal Code HC-1185

Proposal Title The local structure of amorphous pure and Ti-doped Ta₂O₅ films

Beamline ID15A

Dates 12 - 13 Nov. 2014

The aim of the proposal was to study the local structure of amorphous Ta₂O₅ by means of a total scattering experiment with high energy X-rays. This material is applied to build highly reflective mirrors used in interferometric gravitational wave detectors. In order to study the influence of both the annealing and the Ti doping on the coating structure four samples were prepared: pure Ta₂O₅ (annealed and not), Ti-doped Ta₂O₅ (annealed and not annealed).

For these samples experimental plan was articulated as follows:

1. acquisition of high quality synchrotron powder diffraction patterns at ESRF at room temperature suitable for pair distribution function (PDF) analysis
2. reduction of the total scattering data to obtain the PDF function
3. obtaining difference curves between the reference sample (unsubstituted and not annealed) and the substituted and/or annealed samples (difference modelling)
4. apply a reverse Monte Carlo method to analyse total scattering data

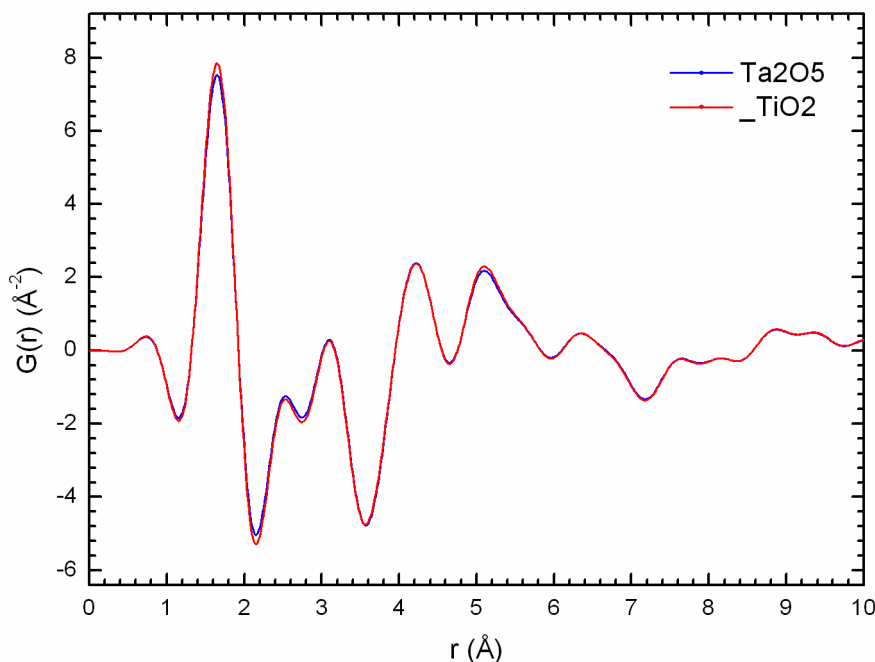


Figure 1: PDF of two samples analyzed by a grazing incidence geometry evidencing subtle differences between a pure Ta₂O₅ and a Ti-doped Ta₂O₅ film (ID15A data).

During the experiment we were able to acquire data for PDF analysis only from two samples (Figure 1); in fact, at first 6 shifts were allocated to analyze the four samples, but afterwards beam time was rescheduled down to only 3 shifts. In any case reliable data were collected from these two samples; the analysis by reverse Monte Carlo method is still in progress in order to determine their average short-range structure.