

X-RAY AND NEUTRON STRUCTURAL INVESTIGATIONS OF LIQUID OXIDES USING AERODYNAMICS LEVITATION AND LASER HEATING

V. Cristiglio^{1,2}, L. Hennet², G.J. Cuello¹, I. Pozdnyakova², S. Krishnan³, A. Bytchkov², D. Zanghi², J.F. Béjar⁴, S. Brassamin², J.F. Brun², H.E. Fischer¹, D.L. Price²

¹ILL, 6, rue Jules Horowitz BP 156 - 38042 Grenoble Cedex 9 - France

²CRMHT, 1d avenue de la Recherche Scientifique, 45071 Orléans cedex 2, France

³KLA-Tencor, San Jose, California 95134, USA

⁴LCG, 25 avenue des Martyrs, 38042 Grenoble Cedex 9, France

The physical properties of a high temperature liquid are related to its atomic structure, it is then important to develop devices to probe the local environment of the atoms in the sample. Aerodynamic levitation combined with laser heating has proved to be powerful and versatile technique for studying the structure of high-temperature liquids using x-ray and neutron scattering [1,2].

Various high temperature setups have been designed at APS (Argonne, IL, USA) [3] and ESRF (Grenoble, France) [4] for making x-ray scattering measurements up to 3000°C. A new environment based on aerodynamic levitation and laser heating is presented. It has been installed on the D4c diffractometer at the ILL (Grenoble, France) [5] for making neutron diffraction in the liquid state.

Samples are levitated using a regulated gas flow and heated to the desired temperatures using three CO₂ lasers used simultaneously from different directions in order to obtain a homogeneous temperature.

Structural studies in the Al₂O₃-Y₂O₃ phase diagram are presented. In particular, we focus on the two end members and the YAG composition (Y₃Al₅O₁₂).

For each sample, we show the total structure factor $S(Q)$ and the corresponding total correlation function $T(r)$. The combination of neutron and x-ray scattering and the use anomalous x-ray scattering make it possible to obtain reliable coordination numbers and distances in the liquid state.

[1] L. Hennet et al., Appl. Phys. Lett. 83, 3305 (2003)

[2] Landron et al., Phys. Rev. Lett. 86, 4839 (2001)

[3] S. Krishnan et al., Chem. of Mat. (2005)

[4] L. Hennet et al., Nucl. Instrum Meth. Phys. Res. B 207, 447 (2003)

[5] L.Hennet et al., Rev. Sci. Instrum. (submitted)