

Summary of my stay in Kyoto

by Julian Evans (April to July 2013)

Thanks to Kyoto University's young researchers exchange programme, I had the opportunity to spend nearly three months with Prof. Yuichi Shimakawa's solid state research group at the Institute for Chemical Research. This stay was also for me a part of the international MaMaSELF course, an Erasmus Mundus masters' course in materials science, exploring large scale facilities. I came in order to perform experiments on brownmillerite-structure oxides, the results of which will be included in my masters' thesis. This project is part of an extended collaboration between Kyoto and the research group of Werner Paulus at the University of Montpellier 2 in France, where I started my thesis work. I had previously studied at the University of Rennes 1 (France) and the University of Turin (Italy) in the 1st and 2nd MaMaSELF years respectively.

The brownmillerite structure is related to the well-known perovskite structure, but contains ordered oxygen vacancies, and has a formula of $ABO_{2.5}$ where A and B are metal cations, and may be useful in applications where oxygen ion diffusion is a helpful property, such as in oxygen separation membranes or solid oxide fuel cells.

My main task in Kyoto was to synthesise Sr_2ScGaO_5 thin films, to evaluate their lattice constants and to observe anisotropic behaviour within the samples. We deposited these films on four different substrates: $DyScO_3$ [110], $DyScO_3$ [100], $LaAlO_3$, and $KTaO_3$, selected due to their suitable lattice constants and orientations. The films were subsequently analysed by X-ray diffraction and reciprocal space mapping. I will return to Montpellier next for further characterisation of the materials and to complete the thesis. The results of this research will be used to determine the oxygen diffusion rate in different brownmillerites, and to synthesise new materials with novel layered structures.

I would like to thank Erasmus Mundus and Kyoto University for funding my outstanding Japanese experience, which has enabled me to develop my laboratory and research skills, and widen my knowledge of the world from a cultural and linguistic point of view. The research has taught me a great deal about the techniques employed during pulsed laser deposition, epitaxial film growth and sample characterisation. I wish the very best of luck to all of the researchers working on the thin film project and to my fellow master students here.

