Research visit to the Shimakawa group, Kyoto University

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This short-term visit was the continuation of the work initiated in my first visit to the ICR thanks to the collaboration between my PhD supervisor Prof. Susana García Martín (Universidad Complutense de Madrid) and Prof. Yuichi Shimakawa (Kyoto University). During this time, I had the opportunity to continue acquiring not only valuable scientific knowledge essential for my future career, but also the chance to get a deeper understanding of the traditions, way of life and culture in Japan.

My research, here, focused on the variation of the anion coordination and oxidation state of the Fe within the perovskite-related (RE,Ba,Ca)FeO_{3-y} (RE = Gd and Y) system. The Fe cation in this system can adopt different stacking sequences and a wide range of oxidation states from less than 3+ to unusual high valence state close to 4+. The extensive availability of synthesis techniques in the Shimakawa Laboratory such as the high pressure-high temperature equipment and the furnaces with different atmospheres (Air, Ar, O_2, O_3, vacuum…) were perfectly suited for our purpose. The Fe oxidation state and anion coordination in the present system were investigated through the Mössbauer Spectroscopy and the Synchrotron X Ray Diffraction (Spring-8 and NSRRC) techniques. The emerging electronic properties, result of the variability of Fe, were studied by means of magnetic susceptibility and electrical resistivity. With those experiments, I could get substantial scientific data while also to deepen the learning of the different techniques.

Among the results obtained, it must be emphasized the study of the $Y_{0.4}Ba_{0.7}Ca_{0.9}Fe_2O_6$, a compound with a five-fold superstructure related to the ordering of Y, Ba and Ca, which helps to induce a charge ordering of the high valence Fe cations at room temperature. This work will result in the submission of an article during the following months.

I acknowledge the support from ICR Short-Term Exchange Program, which allows the young researchers to get very fruitful experiences. I would like to thank once again the Prof. Shimakawa for his guidance during this enjoyable time and also to all the members of the Laboratory, specially to the Prof. Takashi Saito and the Dr. Masato Goto for their kind support with the experiments.