A comparative study of *A*-site ordered quadruple perovskite structures containing divalent manganese, iron, cobalt and nickel square-planar centers

([1]Institute for Chemical Research, Kyoto University, [2]Hakubi Center for Advanced Research, Kyoto University) ○Midori Estefani Amano Patino[1], Fabio Denis Romero[1,2], Sean Injac[1], Masato Goto[1], Yuichi Shimakawa[1]

Keywords: *A*-site ordered quadruple perovskites, High pressure synthesis, Crystal structure characterization, Magnetic property characterization, Magnetic spin ordering

The *A*-site-ordered quadruple perovskite structure of general formula $AA'_3B_4O_{12}$ (Figure 1) can accommodate transition metal (TM) cations at the square-planar *A'* site. The stabilization of these compounds is often challenging and their preparation requires high pressure and high temperature. When the *B* sites of quadruple perovskite structures are occupied by non-magnetic cations, the complex magnetic interactions between the spins at the orthogonally-oriented *A'*-sites can provide a variety of exotic magnetic orders.[1–3]

We recently found that the magnetic structure of the *A'*-site Fe^{2+} spin-sublattice in $CaFe_3Ti_4O_{12}$ adopts an unusual multi-*k* antiferromagnetic arrangement which is affected by applied magnetic fields. Building on these results, we have turned our attention to the synthesis of the series $CaA'_3Ti_4O_{12}$ (*A'* = Mn^{2+}, Fe^{2+}, Co^{2+}, Ni^{2+}) for a comparative study towards further understanding the non-trivial behaviour of the *A'*-site magnetic sublattices in this structural class. Here we present some insights on the challenging synthesis and the results from characterization of these materials.

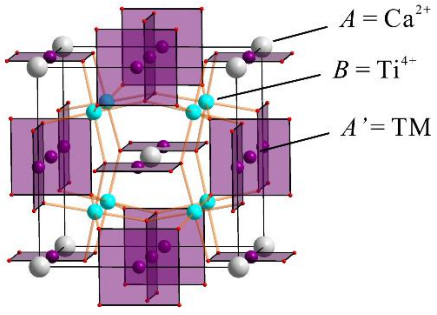

Figure 1. Representation of the structure of the quadruple perovskites were small TM cations (*e.g.* Mn^{2+}, Fe^{2+}, Co^{2+}, Ni^{2+}) can be accommodated at the *A'* square-planar site.

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