**Poster Presentation**

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*In situ synchrotron powder diffraction for an ionic conductor transition*

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In situ synchrotron X-ray powder diffraction can be one of the most powerful probes to investigate the structure evolution by a chemical reaction thanks to simultaneity of data collection. It is not, however, with ease to produce a homogeneous chemical reaction in the limited spaces, which is essential to see an atomic-scale structure evolution. We have developed an in situ capillary cell for both high-temperature H\(_2\) reduction and precise humidity control at the SPring-8 BL44B2. We successfully applied this in situ system to an electronic conductor LaSr\(_3\)Fe\(_3\)O\(_{10}\), which is transformed into an ionic conductor by the two-step chemical treatments [1]. LaSr\(_3\)Fe\(_3\)O\(_{10}\) has a triple-layer structure with a FeO\(_6\) octahedral unit. One triple layer is bonded with another layer through van der Waals interaction. Structure refinements with in situ synchrotron powder diffraction data revealed that the H\(_2\) reduction at 613 K produced in-plane oxygen vacancies, which resulted in suppression of the interlayer interaction. We found from charge density studies and Raman spectroscopy measurements that the following humidification intercalated H\(_2\)O and OH\(^-\) into the interlayer and intralayer, respectively. That means that H\(_2\)O plays a role for suppression of three-dimensional electronic conductivity, stabilizing the intercalation structure. On the other hand, the OH\(^-\) ions behave as carriers for ionic conductivity, maintaining the charge neutrality in the intralayer. Finally we determined the composition of the ionic conductor to be LaSr\(_3\)Fe\(_3\)O\(_{8,0}\) (OH)\(_{12}\)•2H\(_2\)O, which indicates a transformation of LaSr\(_3\)Fe\(_3\)O\(_{10}\) into an OH\(^-\) ionic conductor. In the presentation, I will discuss the OH\(^-\) ionic conduction channel based on electrostatic potentials obtained from charge densities.


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