**SrCo_{1-x}Fe_xO_{3-δ}: Structure Property Relation**

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The family of perovskite related Sr and Co containing compounds has received considerable attention as oxygen-permeating membranes, sensors, or cathodes for Solid oxide fuel cell (SOFC) because of their high oxygen permeability values [1]. SrCoO_{3-δ} phases with 3C-like crystal structures are presented as mixed conductors with very high oxygen permeability [2]. On the other hand, the SrCoO_{3-δ} samples with 2H-like hexagonal structures at room temperature (RT) have shown to be almost non-oxygen permeable [3].

Recently, A-site ordered 314 phase with composition Sr_{0.7}Y_{0.3}CoO_{2.65} [4] has been reported to crystallize with a novel oxygen vacancy ordering that gives a tetragonal structure (space group I4/mmm), with 2a_p×2a_p×4a_p unit-cell, where a_p is the parameter of the cubic perovskite unit cell. At the same time, the compound is a mixed oxide-ion/electronic conductor exhibiting good activity for the oxygen-reduction reaction, which makes it a competitive cathode material for an intermediate-temperature (IT) SOFC [5].

The aim of the present work is to stabilize the Sr-Co-O system in a 314-type oxygen vacancy ordered structure without A-site ordering to provide the high oxygen mobility within the oxygen deficient plane, which will be adequate for the cathode of an IT-SOFC. With this in mind, we have substituted Co in the SrCoO_{3-δ} system by Fe. Here, we present and discuss a systematic and detailed composition-structure-property relation for the SrCo_{1-x}Fe_xO_{3-δ} samples. The investigation on the evolution of crystal structures with Fe substitution and their structural determination is carried out using the X-ray and Neutron powder diffraction patterns. Three different oxygen vacancy ordered structure is observed for different Fe substitution and the driving forces to stabilize the 314-type oxygen vacancy ordered structure without A-site ordering and their relevance for the cathode of an intermediate temperature SOFC will be discussed.