Combinatorial Sputter Synthesis and Characterization of La-Co-based Thin-Film Perovskite Materials Libraries

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Compositionally complex perovskites are considered potentially stable and active catalysts for electrochemical applications. Through combinatorial synthesis and characterization of thin-film material libraries, the structural and functional properties along continuous compositional gradients are investigated and correlated. Contrary to the expected continuous composition gradient, single-phase regions with homogeneous composition (La2O3 or stoichiometric La-perovskite) form during reactive co-sputter deposition of La-based perovskite. This effect of self-organized thin film growth can be used to synthesize perovskite (ABO3) thin-film libraries covering a wide range of chemical compositions for the B-site elements in phase-pure perovskite regions. This approach facilitates the discovery and tailoring of chemical compositions for desired functional properties. The synthesized material libraries were screened for their electrocatalytic activity in the oxygen evolution reaction, which led to the identification of a region with interesting catalytic activity in the La-Co-Mn-O system. In-depth characterization of this region revealed a unique columnar-grown microstructure with a large catalytic surface and excellent stability during electrocatalytic measurements. [1]

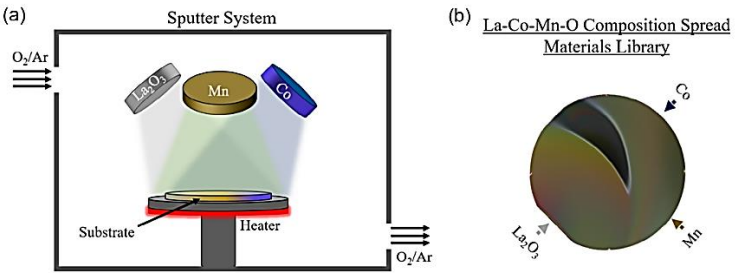

Figure 1: a) Schematic drawing of the reactive sputter process on heated substrate to fabricate the La-Co-Mn-O materials library. b) photo of the materials library, sputter target positions are indicated by arrows and the respective elements [1]

[1] T. H. Piotrowiak, O. A. Krysiak, E. Suhr, J. Zhang, R. Zehl, A. Kostka, W. Schuhmann, A. Ludwig, Sputter-Deposited La–Co–Mn–O Nanocolumns as Stable Electrocatalyst for the Oxygen Evolution Reaction. *Small Structures*, 2024, 5. Jg., Nr. 5, S. 2300415, DOI: 10.1002/sstr.202300415