Aqueous CSD synthesis of metallic conductive oxides for use as bottom electrode for ferroelectric films

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Here, aqueous CSD routes are presented for the preparation of RuO_2, $SrRuO_3$ (SRO) and $La_{1-x}Sr_xCoO_3$ (LSCO) conductive thin films. It is known that many ferroelectric memory devices suffer from interface-related degradation problems like fatigue when conventional metal electrodes are used. Metallic conductive oxides are considered as excellent candidates to replace Pt as electrode material in ferroelectric memory devices because of their high chemical stability and good corrosion characteristics. Additional assets of perovskite structured SRO and LSCO are the crystal structure and lattice parameters, which promote the growth of phase pure Ti-based ferroelectric materials.

The first step in the synthesis of (multi-) metal oxides by aqueous CSD is the preparation of stable aqueous monometallic precursors. Hydrolysis of the metal ions in water is prevented by chemical modification with appropriate chelating agents such as EDTA or citric acid. The use of water as the solvent has great economical and ecological advantages in comparison to alcoholic sol-gel routes.

Once a stable solution is obtained, thin films can be prepared by spin-coating this solution onto Si/SiO_2 substrate. A crucial issue of aqueous chemical solution deposition is the wettability control of the substrate. In order to improve degree of hydrophilicity a wet chemical cleaning method is used to modify the substrate's surface. With the appropriate thermal treatment of the as-deposited film phase pure highly conductive thin layers can be obtained. Thin film morphology and crystallisation were studied by means of (X-)TEM, SEM, XRD and XPS. Electrical resistivity of the films is measured by a four-point probe method.