Highly conducting oxides as substitution for transparent conducting materials and metal electrodes in microelectronic devices

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Substitution for critical and expensive chemical elements such as Au, Pt, Pd, and In in microelectronic devices is an important trend to meet the economic and environmental demands. Perovskite oxides with high electric conductivity and high optical transparency in the visible spectral range are considered good candidates for the use as transparent conducting layers in modern displays as well as electrode materials in passive microwave devices such as tunable ferroelectric microwave capacitors (varactors).

In varactors, the permittivity of a perovskite oxide dielectric layer and, therefore their capacitance is tunable with an external electric field. Using isostructural perovskite conducting electrodes, a critical improvement of the varactor performance is observed due to the suppression of the acoustic resonances at high frequencies for the upcoming data communication protocols, such as 5G mobile technology.

The main focus of our multidisciplinary research is on a transition metal perovskite oxide $SrMoO_3$ exhibiting a Mo^{4+} $4d^2$ electronic configuration. $SrMoO_3$ thin films with the room-temperature resistivity of 20-30 μΩcm are used as conducting electrodes in all-oxide microelectronic devices, replacing the current industry standard Pt. Moreover, $SrMoO_3$ thin films offer excellent optical transmittance, making them a competitive and low-cost alternative to indium tin oxide (ITO) - a leading material in the market of Transparent Conducting Materials (TCMs).