

Engineering of LiNbO₃ Films for Next Generation Acoustic Wave Devices

Ausrine Bartasyte¹, Vincent Astié¹, Sabina Kuprenaite¹, Samuel Margueron¹

¹FEMTO-ST Institute, University of Bourgogne Franche-Comté

The next generations of Radio-Frequency (RF) wide-band filters or frequency-agile filters are urgently needed for the development of 5G infrastructures/networks/communications. Today, LiNbO₃ and LiTaO₃ single crystals are key materials in electro-optics and RF acoustic filters. This motivates further development of acoustic wave devices based on high electromechanical coupling LiNbO₃ thin films, adapted to the above-mentioned RF applications. The challenges and the achievements in the growth of LiNbO₃ films and their integration with Si technology to develop disruptive acoustic devices will be discussed in detail. The deposition techniques enabling the control of film composition/non-stoichiometry of volatile alkali metal oxides and the methods of compositional analysis will be presented. A particular effort was made to achieve the epitaxial growth of films with controlled single orientation and nearly stoichiometric Li₂O composition as well as to texture these films with highly-coupled orientations on Silicon-based heterostructures. We have demonstrated acoustical performances compatible with filter applications for SAW devices, based on epitaxial LiNbO₃ films, operating at frequencies in the vicinity of 5 GHz. Future prospects of potential applications and the expected performances of thin film acoustic devices are presented and discussed as well.