Impact of solution ageing on the Er^{3+}/Yb^{3+}:$LiNbO_3$ thin films properties

Dana Mikolášová[1], Kateřina Rubešová[1], Vít Jakeš[1], Pavla Nekvindová[1], Marcela Dendisová[2], and Jiří Oswald[3]

[1]*Dept of Inorganic Chemistry, University of Chemistry and Technology Prague, Technická 5, 166 28 Prague 6, Czech Republic*
[2]*Dept of Physical Chemistry, University of Chemistry and Technology Prague, Technická 5, 166 28 Prague 6, Czech Republic*
[3]*Institute of Physics of the Czech Academy of Sciences, Cukrovarnická 10, 162 00 Prague 6, Czech Republic*

$LiNbO_3$ is still one of the most applied oxides in optoelectronics, acusto-optics, ferroelectrics etc. The $LiNbO_3$ thin films are produced by various methods, e.g. liquid phase epitaxy, molecular beam epitaxy, pulsed laser deposition, chemical vapour deposition, physical vapour deposition or sol-gel techniques. Generally, sol-gel methods are cheaper than other deposition methods and can ensure the homogeneous distribution of potentially functionalizing dopants. On the other hand, the quality of thin films is ensured only if the synthesis and deposition of solutions is reproducible and standardized. Therefore, mainly freshly prepared solutions are utilized, which, apart from being time-demanding, requires high purity starting compounds that are not cheap.

To solve this problem, not only freshly prepared solutions could be used, especially in the case of automatized deposition. In such a case, however, the time-dependent physical-chemical behaviour of solutions, which can affect the microstructure and thus physical properties of films, needs to be studied.

In our work, the thin films were deposited using an aqueous solution of polyvinylpyrrolidone (PVP) that chelates and stabilizes the present cations (Er^{III}:Yb^{III}:Li^{I}:Nb^{V}). The solutions were left to age for up to 10 months. These solutions were characterized by MIR and TG/DTA analysis. Thin films were then deposited from the aged solutions by spin-coating and various thermal treatment regimens were tested. The waveguiding, luminescent and microstructural properties of the final films were examined.

Financial support from specific university research (MSMT No 21-SVV/2020).