FAST IMAGING OF THE PLUME EXPANSION PRODUCED BY LASER
ABLATION OF LiNbO_3

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LiNbO_3 is one of the most interesting material for optoelectronic applications due to its excellent piezo-electric, acousto-optic, electro-optic ... properties. Its widespread use has been hindered by the difficulties in producing good quality thin films, the formation of a Li deficient phase being the most widely reported result whose origin is still unclear. The best results reported so far seem to be those produced by pulsed laser deposition (PLD).

The ejection of Li (lighter) species with a different solid angle than the Nb/O (heavier) species and/or the scattering of Li species by the heavier ones have been proposed as possible mechanisms responsible for the observed Li deficiencies. In addition, the observation of the target after ablation has shown an oriented re-crystallisation with many cracks or new facets which might promote the ejection of Li along preferred directions in respect to the normal to the target. The aim of this work is thus to analyse the expansion dynamics of Li atoms produced by laser ablation of LiNbO_3 , since the analysis of two-dimensional images of the plume should clarify the existence of preferred directions for the movement of the Li species as compared to the others. The use of two monocrystalline targets with different orientation (z-axis normal and parallel to the surface respectively) should in addition evidence if the ejection mechanism depends on the orientation of the crystal.

Fast photography of the plume has been performed by an image intensified CCD (ICCD) camera which allowed us to record images of the plume at different times after the laser pulse, from several nanoseconds to one or two microseconds, when practically no plasma emission could further be detected. The results show that ablation is initiated differently from each target, although these differences are progressively reduced after several minutes. Once the stationary regime is reached the plasma expansion shows in both cases similar features (velocity, angular distribution and temporal duration of the plume). Nevertheless, the results show also the existence of a delayed Li population (up to 500 ns) with respect to the overall plume emission, which might influence the film growing process.

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