## 3.11 Molecular Beam Epitaxy of $LiTaO_3$

(F.Gitmans and Z.Sitar)

Lithium tantalate ($LiTaO_3$) is one of the most commonly used materials for pyroelectric detectors due to its large pyroelectric coefficient and excellent chemical stability. In our molecular beam epitaxy (MBE) growth process, chemically cleaned wafers underwent a low temperature (200°C) desorption step in the load lock and were subsequently thoroughly desorbed for 30 minutes at 900°C under UHV conditions in the transfer system. After the introduction to the deposition chamber and prior to deposition, they were heated to a desired temperature and the material fluxes of tantalum, lithium, and oxygen were stabilized at a desired level. A range of different temperature and flux parameters as well as different substrates have been used for the deposition experiments.

First growth experiments were performed on Si(100) and Si(111) substrates. The grown films were amorphous at low substrate temperatures, while at moderate deposition temperatures (500 - 700°C) they showed a poor multiphase polycrystalline structure when the lithium flux was increased to a value of two to three times higher than that of the tantalum flux. The reason for the poor crystalline quality was found to be a thin layer of amorphous silicon oxide which formed on the clean Si surface during the molecular flux and ECR stabilization phase prior to the growth process. Thin films of a similar quality were grown also on amorphous glass substrates.

The silicon oxidation problem during the growth initiation phase was solved by first depositing a thin (100 Å) epitaxial layer of platinum on a (111) surface. The surface quality of this layer was considerably improved by an annealing step at 715°C for 30 minutes, as confirmed by the reflection electron diffraction (RHEED) and high resolution transmission electron microscopy (HREM) studies. The crystalline quality of the surface prepared in this way was not hampered by oxygen. The growth of $LiTaO_3$ on this sample showed a good crystalline quality and resulted in two preferred orientations, (006) and (102). XPS studies confirmed a stoichiometric composition of the deposited films.