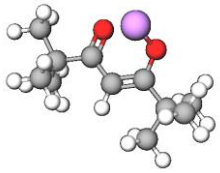
DLI-CVD of Lithium Niobate

Turn-key equipment and process solutions

Chemicals and Handling

- **Tetrakis(2,2,6,6-tetramethyl-3,5-heptanedionato) Niobium(IV):** $Nb[TMHD]_4$
- **2,2,6,6-Tetramethyl-3,5-heptanedionato Litihum:** Li[TMHD]
- **Solution:** 0.01M in Mesitylene solvent
- **Oxidizing agent:** O_2
- **Precursor tank:** Full rinsing capability, Solution kept at RT
- **Liquid delivery panel:** PLC control with Ethernet interface

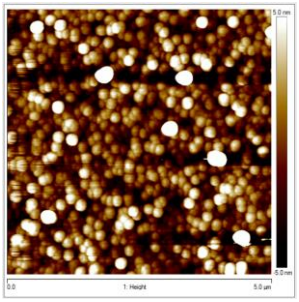


- **Direct Liquid Injection technology:**
  - Wide range of organometallic precursors available
  - Highest vaporization efficiency for CVD/ALD
- **Precursor injection:** Close loop pulsed gas flow injection
  - Precise and reproducible precursor flow control
  - Fine control of the material stoichiometry
- **Resistive rotating substrate holder:**
  - Precise control of the temperature from RT to 850 °C
  - Position adjustment in the reactor chamber: 100 mm motion.
- **Automatic process control:** Real time display/data collection
- **Remote operation:** Industrial PLC and TCP/IP com

Thermal CVD $LiNbO_3$ film:

Pure single $LiNbO_3$ phase
Controlled Li nonstoichiometry
Epitaxial growth

Growth rate: 0.3 to 0.6 nm/min
Thickness < 300 nm
Roughness : < 5% thickness
Thickness homogeneity:
10% on 4” wafer

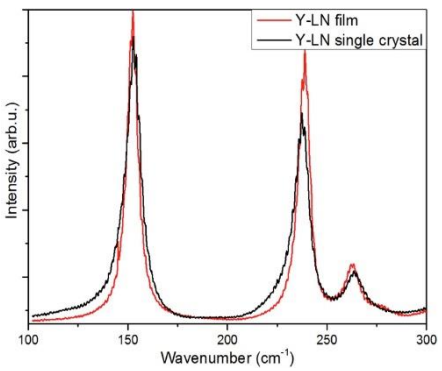


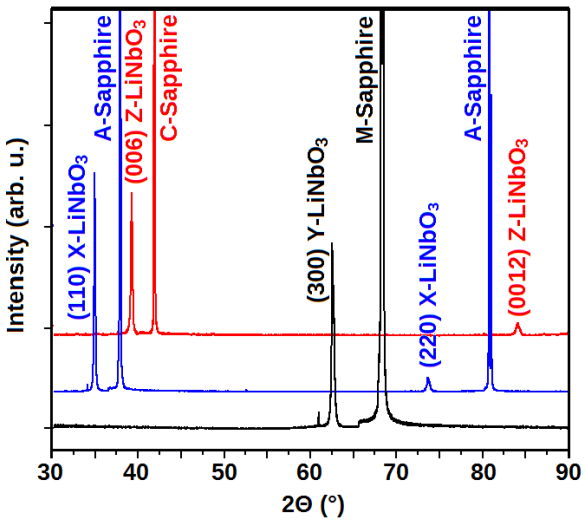
Z-$LiNbO_3$ on C-Al_2O_3
RMS = 4.02 nm

Raman spectroscopy of Y-$LiNbO_3$ on M-Al_2O_3

Congruent crystal:
Li_2O - 48.34 mol%

$LiNbO_3$ thin film:
Li_2O – 49.4 mol%





XRD: Epitaxial growth X-, Y- and Z- oriented films on sapphire substrates

FWHM of rocking curve:
0.29 ° (Z-$LiNbO_3$ film)
0.23 ° (C-sapphire)