Facility for the single crystals growth and characterization in SSPD, BARC

Why Crystals:

- Anisotropic materials: Experiments can done along different crystallographic axes
- Subtle features can be observed only in high quality single crystals
- Neutron scattering experiments: Large single crystals

Optical Floating Zone Technique Advantages

- Reduce contamination of the melt by crucible
- Oxide melting as high as 2200° C can be grown
- Growth can be conducted at high pressure (up to 9.5 atm) and in specific atmosphere
- Solid solution with controlled composition can be prepared
- Easy to 'extract' crystals
- Ideal for growth of oxides single crystals

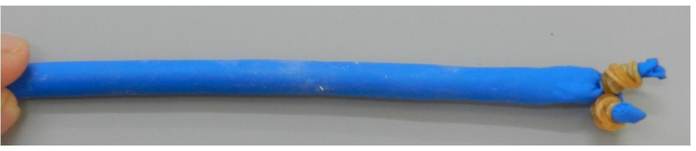
Flow chart

Raw materials
↓
(Mixing)
↓
(Calcination)
↓
(Grinding)
↓
Molding
↓
Sintering
↓
Floating zone growth
↓
Single crystal
↓
Characterization

Optical Floating Zone Furnace

Specifications	
Model	FZ-T-10000-H-VII-VPO-PC
Type of Lamp	Halogen
No. of Mirrors/Lamps	Four
Max Operating Temperature	2200° C
Lamp power	300W, 1000W, and 1500 W
ID of Quartz Tube	61.4 mm
Mirror Slow Movement	0.01-300 mm/hr
Max Pressure	9.5 bar (For growing materials with higher vapor pressures)
Max Vacuum	5×10^{-5} Torr （6.7×10^{-3}Pa）
Max Temperature	2200 °C
Max Crystal Growth Length	150 mm
Growth rate	0.1-30 mm/hr
Max Crystal Growth Length	150 mm
Sample Chamber can be filled with inert, reductive, oxidizing atmospheres	

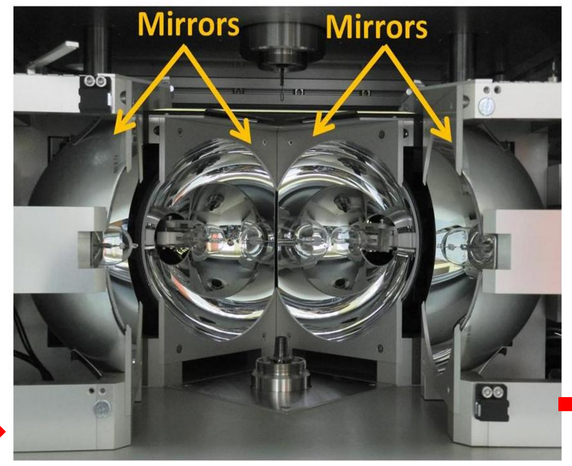
Feed Rod



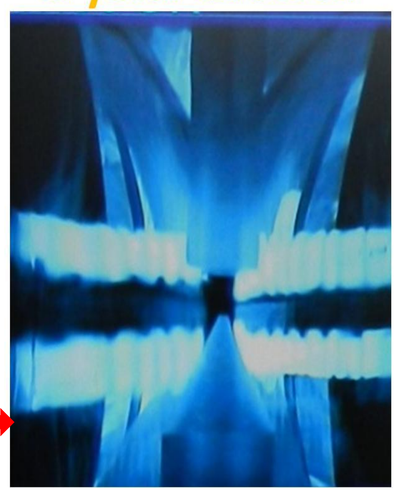
Cold Isostatic Press

Vertical Furnace with Rotational Lifter (For sintering rod)

4 Mirror Optical Furnace



Crystal Growth

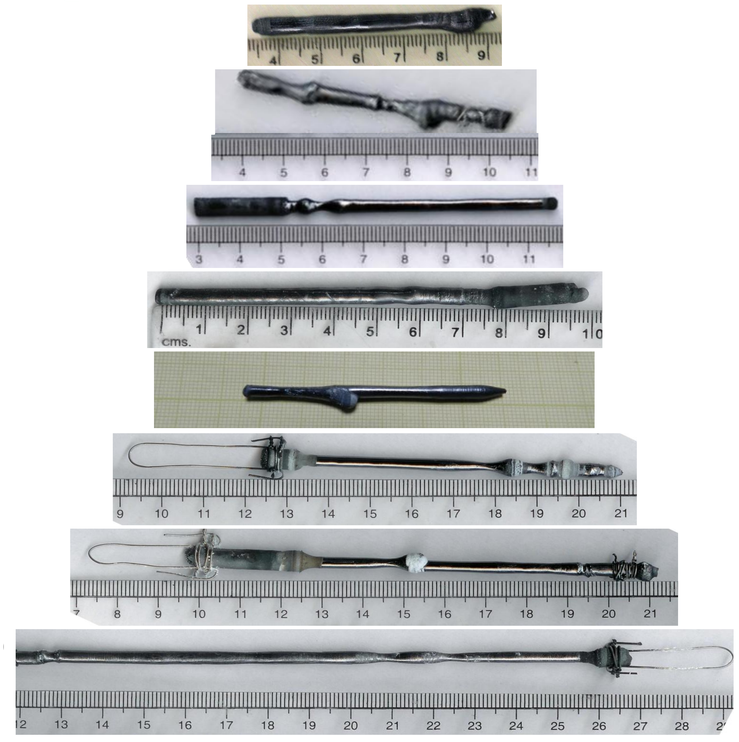


➢Characterization

Back-Reflection Laue Camera System

Model	Proto LAUE -COS
x-ray source	Molybdenum (Mo)
x-ray beam size	0.2-0.5 mm (diameter)
Detector	Transmission and back-reflection CCD camera with an active area size of 100 mm x 150 mm
Filter	Zirconium (Zr)
Flux	4×10^8 photon/mm^2/sec
Goniometer	A fully motorized three-axis rotation goniometer

$LiCoO_2$: Cathode material for Li-ion battery



A. Jain, A. Mohan, and S. M. Yusuf, J. Cryst. Growth 536, 125578 (2020).