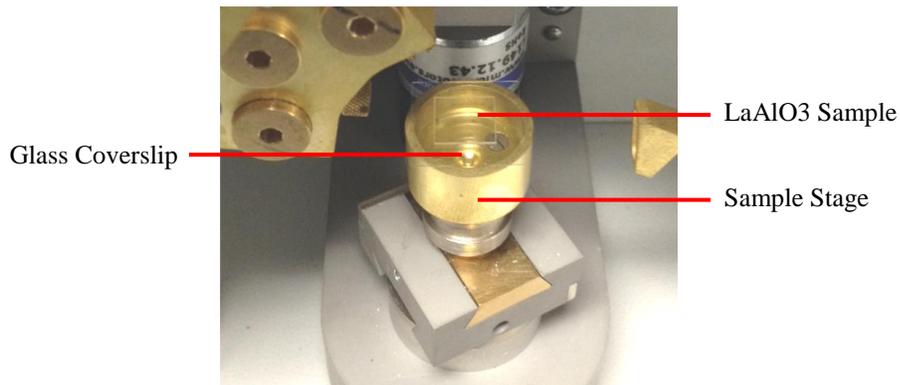


X-Ray Diffraction of (100) LaAlO₃ Single Crystal Substrate Using Mini X-Ray Diffractometer (EQ-MD-10-LD)

This application note shows the results of X-ray diffraction characterization using [Mini X-ray Diffractometer \(EQ-MD-10-LD\)](#). The sample used is MTI [LaAlO₃ \(100\), 10x10x0.5 mm substrate, 2 side polished](#).

Measurement Procedures

1. Open the MD-10 diffractometer front door. Cover the sample stage with a glass coverslip. Put the LaAlO₃ single crystal on the glass coverslip and center it. Use the lever to determine the proper sample height (the lever should barely pass above the sample without friction). Adjust the stage height by rotating the holder support if necessary.



2. If the automatic sample rotation needs to be turned off for the single crystal sample, unplug the power supply cable of the rotation stage as indicated in the picture below.



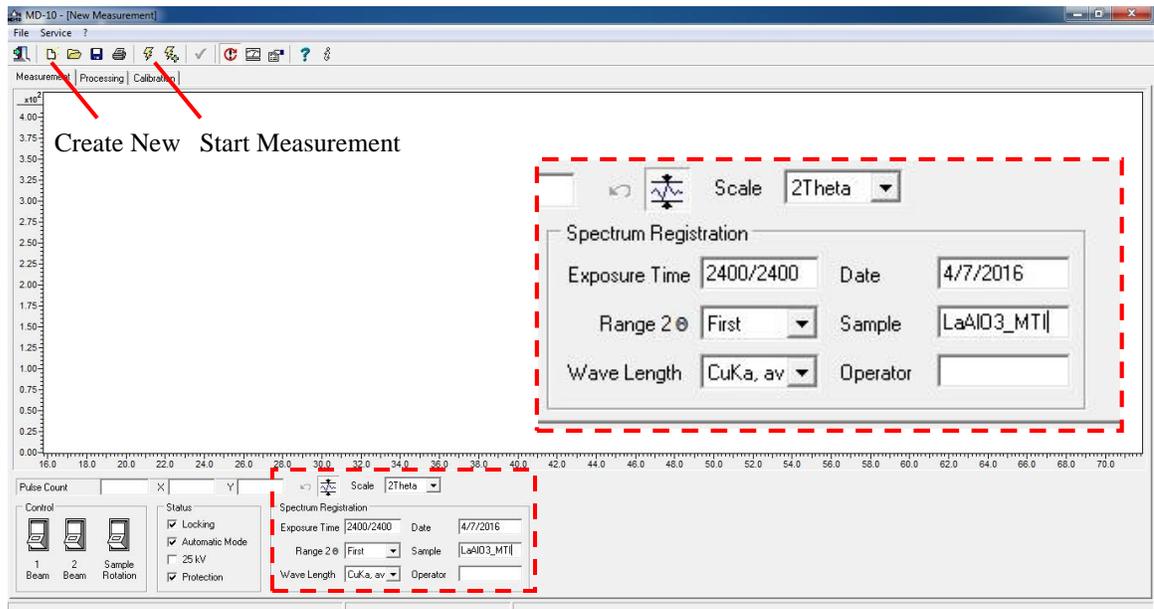
3. Switch on the MD-10 diffractometer, and let the X-ray tube to warm up. Power up the computer and open the MD-10 software. Make sure the diffractometer has been recently calibrated using the included standard Al₂O₃ powder. Please refer to “MD-10 Calibration” application note for details. Create a new measurement, and set up measurement conditions as follow:

Scale – 2Theta

Exposure Time – 2400/2400 (40 min)

Range 2θ – First (X-ray Beam 1, 16° - 71°)

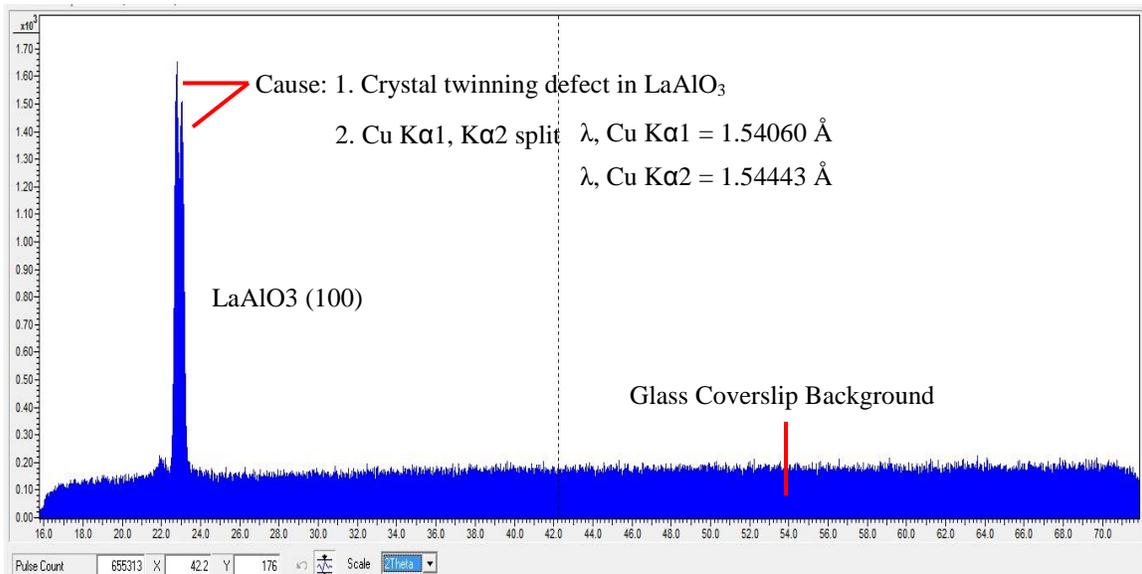
Wave Length – Cu Kα, avg ($\lambda = 1.54178 \text{ \AA}$)



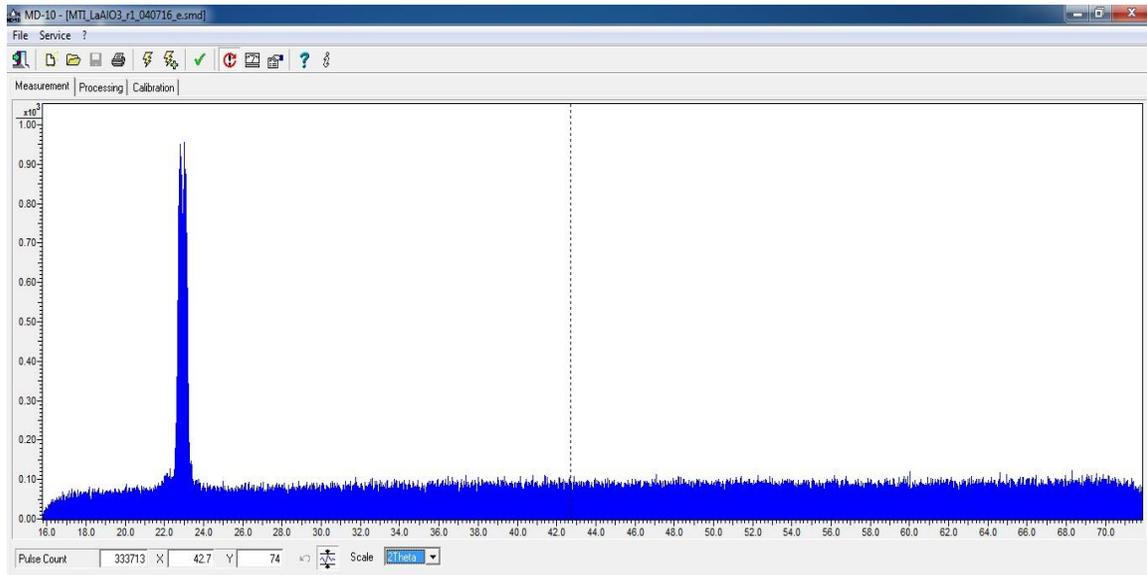
4. Click "Start Measurement". Wait for the measurement to finish.

Results

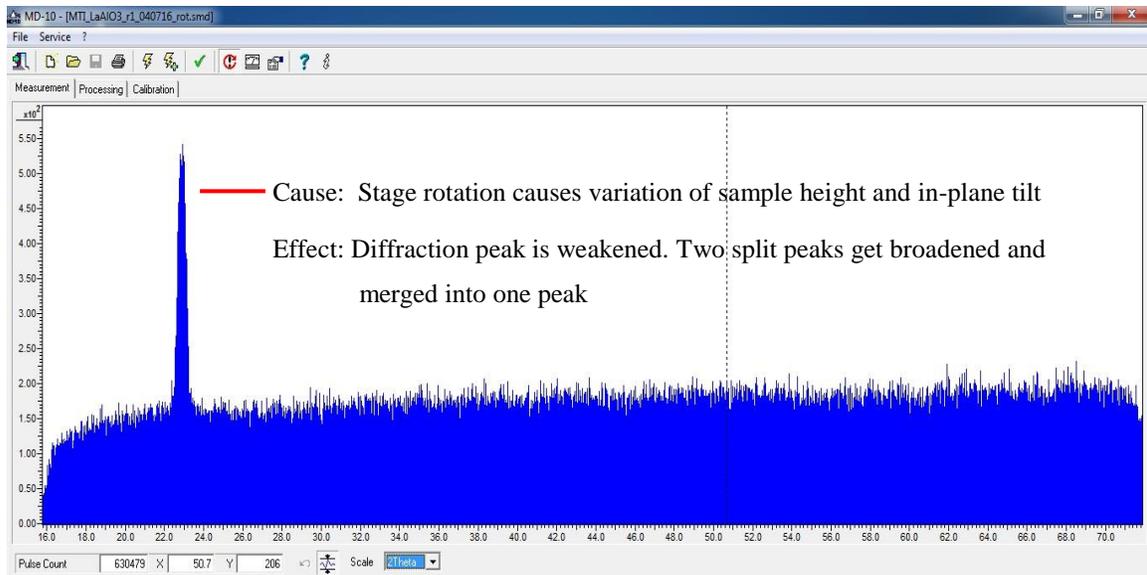
Measurement 1: No sample rotation. Random in-plane angle.



Measurement 2: No sample rotation. Random in-plane angle.



Measurement 3: Sample rotation ON.



Discussion

The above results confirm that LaAlO₃ substrate is a single crystal grown in <100> direction. The main peak position matches with the LaAlO₃ cubic (100) peak reference. The split of the main peak into two peaks could be caused by either 1) crystal twinning defect in LaAlO₃ substrate, or 2) Cu Kα₁, Kα₂ X-ray split.

For Mini XRD, besides its main powder diffraction function, it is also capable of characterizing single crystal samples. The user should be noted that 1) only out-of-plane lattice planes and their peaks can be measured, since MD-10 does not have Chi (sample tilt) and Phi (sample rotation) control; 2) the stage rotation should be turned off at the start of the measurement. Otherwise, the stage rotation would cause a small variation of sample height and sample in-plane tilt, weakening and broadening the diffraction peaks.