

DIFFRACTION GRATINGS

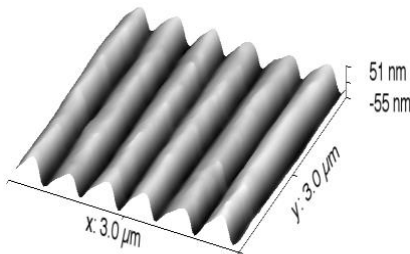


Inprentus manufactures blazed diffraction gratings for x-ray and ultraviolet applications using a nanoscale, contact-mode lithography technique, a method of controlled mechanical deformation of metallic surfaces. This technology is particularly suited to x-ray and UV diffractive optics in which features must be shaped with 0.1 degree angular precision and positioned with nanometer precision over distances of 100s of millimeters.

Mechanically Ruled VLS Blazed Diffraction Gratings

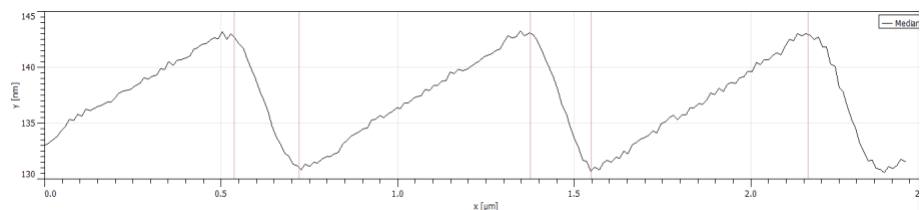
| Specification | Capability Range |
|--|--|
| Resolving power ($\lambda/\delta\lambda$): | Over 50,000 on a best effort basis |
| Blaze angle: | As low as 0.1° |
| Line Density: | Below 100 and above 2000 |
| VLS law: | $N(w) = a_0 + a_1w + a_2w^2 + a_3w^3$ |
| Substrates: | Planar or lightly curved, single crystal silicon or fused silica |
| Dimensions (clear Aperture): | Up to 500mm long x up to 200mm wide |
| Coating: | Ti or Cr adhesion layer, Au ruling layer |
| Overcoating: | Ni, BaC, Pt, etc. available through contracting of 3rd party vendors |
| Delivery: | Subject to project specifications |
| Warranty: | 12 months after delivery |

Blaze Angle Profiles



Left: 3D rendering of AFM traces of a grating pattern

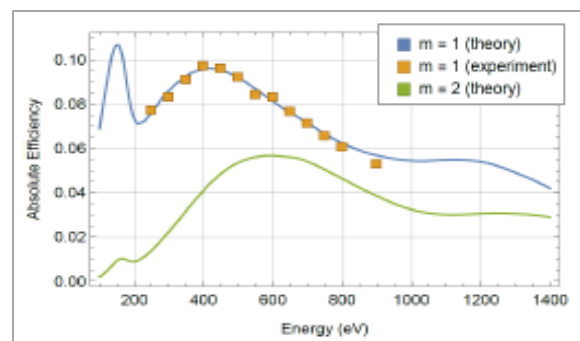
Below: A single unsmoothed AFM trace of a 1500 lines/mm grating with a blaze angle of 1.1°



Efficiency Simulations

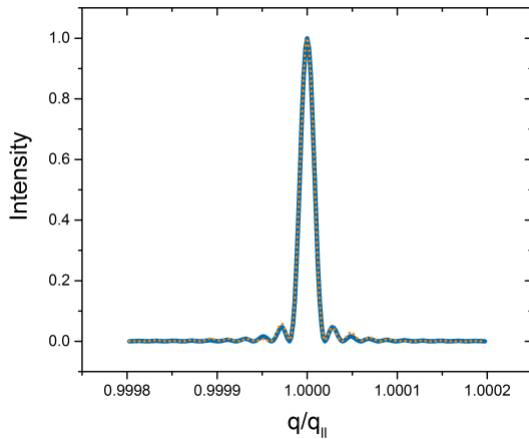
The 1st order diffraction of an Inprentus grating was measured and compared to Inprentus efficiency simulations. Efficiency simulations were conducted using real AFM data from blaze angle characterizations.

Inprentus simulation services are available with all grating purchases and provide very reliable predictions of in-beamline grating efficiency.



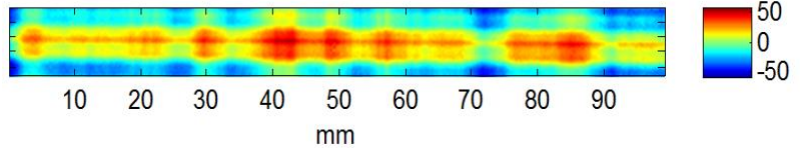
BLAZED DIFFRACTION GRATINGS

Resolving Power



Left: Resolution function, $R(q)$, reconstructed from the Fizeau data below, showing a resolving power of $E/\Delta E = 50,400$

Bottom: Fizeau interferometry measurement in Littrow geometry of a uniform (non-VLS) 500/mm grating, taken by Brookhaven National Laboratory. The “height” in this image is a measure of the line density, showing the local variations.



Experimental Results from RIXS Applications

Right: Resonant Inelastic X-ray Scattering (RIXS) data from Beamline 8.0.1 at the Advanced Light Source at Lawrence Berkeley National Laboratory. The inclusion of an Inprentus grating into the RIXS endstation at Beamline 8.0.1 greatly enhanced the throughput of the experiment and increased the efficiency of data acquisition.

Related Publication: “High-efficiency in situ iRIXS endstation at the ALS” Qiao et al., Review of Scientific Instruments 88, 033106 (2017)

