

# DIFFRACTION GRATINGS

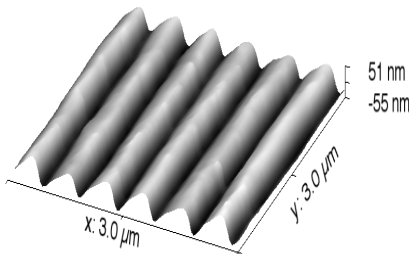


**Inprentus** manufactures blazed diffraction gratings for x-ray and ultraviolet applications using a nano-scale, contact-mode lithography technique, a method of controlled mechanical deformation of metallic surfaces. This technology is particularly suited to x-ray and UV diffractive optics in which 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

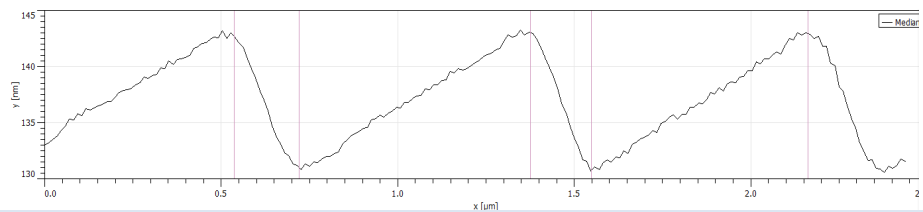
Specification	Capability Range
Resolving power ( $\lambda/\delta\lambda$ ):	Over 50,000 on a best effort basis
Blaze angle:	As low as 0.1°
Line Density:	Below 100 and above 2000
VLS law:	$N(w) = a_0 + a_1w + a_2w^2 + a_3w^3$
Substrates:	Planar or lightly curved, single crystal silicon or fused silica
Dimensions (clear Aperture):	Up to 500mm long x up to 200mm wide
Coating:	Ti or Cr adhesion layer, Au ruling layer
Overcoating:	Ni, B <sub>4</sub> C, Pt, etc. available through contracting of 3 <sup>rd</sup> 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

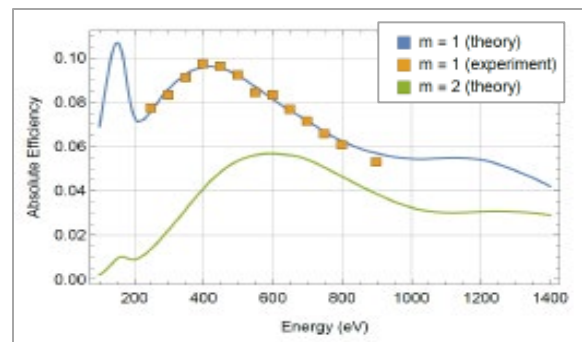
Below: A single unsmoothed AFM trace of a 1500 lines/mm grating with a blaze angle of 1.1°



### Efficiency Simulations

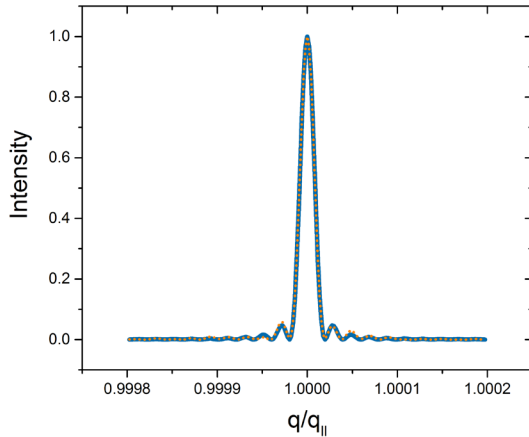
The 1<sup>st</sup> order diffraction of an Inprentus grating was measured and compared to Inprentus efficiency simulations. Efficiency simulations were conducted using real AFM data from blaze angle characterizations.

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



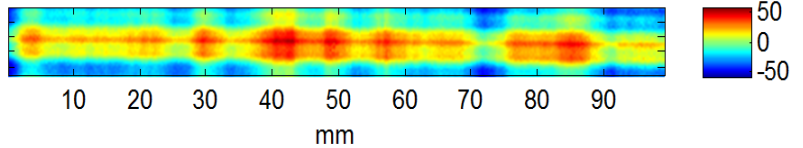
# BLAZED DIFFRACTION GRATINGS

## 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)

