

## Technical Data Sheet

### Hard Gold Coated Copper Mirrors



#### Introduction

Our hard gold coated nickel copper (NiCu) mirrors are the most widely used of all the Cu mirror types. They consist of a copper substrate, precision lapped to the required surface form, plated with a thin layer of nickel which is polished and hard gold coated.

Copper substrates are ideal for many laser applications due to the high thermal conductivity of the material. All copper used in the manufacture of these mirrors is high specification, oxygen-free (OFHC).

#### Dimensions and tolerances

NiCu mirrors can be fabricated in sizes from 5.0mm to 250mm diameter and in thicknesses from 3mm upwards, to suit the mirror diameter and type of cooling required.

Long-radius mirrors are available, including 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 12, 14, 15, 20, 25, 30 metres.

#### Specifications/tolerances

Diameters	+0/-0.15mm
Thickness	± 0.15mm
Parallelism	ETV within 0.05mm
Surface form accuracy	<math>\lambda/20</math> (10.6 $\mu\text{m}$ ) over 90% of diameter
Surface roughness	<math><20\text{\AA}</math> RMS
Phase Retardation	<math><1</math> (at 45° incidence)
Reflectivity	see tables on page 2
LIDT	see tables on page 2

#### Standard sizes

Diameter	Thickness (air cooled)	Thickness (water cooled)
25.0mm	4.0 or 6.0mm	
38.0mm	6.0, 8.0, 10.0mm	25.0mm
50.0mm	10mm	25.0mm
75.0mm	15.0mm	25.0mm
100.0mm	25.0mm	25.0mm

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### Custom made mirrors

LBP Optics NiCu hard gold coated mirrors are available with many custom features including:

- Rectangular, square, prisms, axicons, chopper wheels, knife edge mirrors and shutter mirrors
- Custom water-cooling fittings
- Central or offset holes, holes at 45 degrees to the surface, tapped helicoiled holes
- Convex radii, arrays of holes
- Special shapes, including flanged mirrors

### Laser Damage Thresholds

(the stated LIDT values apply to clean, unstressed components.)

#### Pulsed LIDT

Measurements indicate a typical value of 46.7J/sq. cm for 100 nsec pulses.

This translates to a pulsed LIDT value of 4.67 megawatts/mm<sup>2</sup> for 100 nsec pulse length.

#### CW LIDT

Measured values of CW LIDT for air-cooled, unstressed LBP Optics NiCu mirrors are typically 4000W/mm +/-12%

### Reflectivity

The tables below give typical values for the reflectivity of a hard gold plated surface vs. angle-of-incidence (for 10.6um) and vs. wavelength.

Table 1 shows computed values calculated from the known optical properties of gold.

Table 2 gives experimentally-measured values.

(NB, actual incidence angles of 90 deg are not practically possible.)

Table 1		
Incidence (°)	R(s) %	R (p) %
0	99	99
10	99.02	98.99
20	99.06	98.94
30	99.14	98.85
40	99.24	98.7
50	99.36	98.45
60	99.5	98.02
70	99.66	97.12
80	99.83	94.45
90	100	100

Table 2	
Wavelength (µm)	R %
1	97.9
2	97.9
3	98.1
4	98.3
5	98.4
6.3	98.5
7	98.5
8	98.5
9	98.5
10	98.6
10.6	98.6
11	98.6