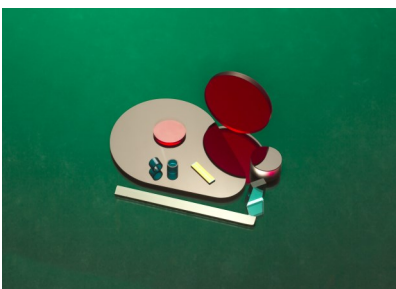
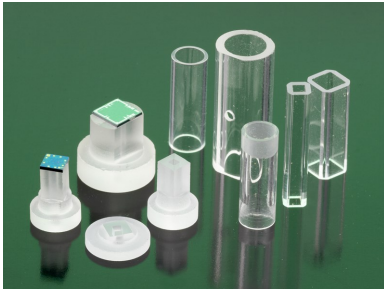




BUSINESS INFORMATION

- **Legal Name:** P. N. E., Inc
dba IRD Glass, IRD Ceramics
- **DUNS #:** 038386462
- **In business since** 1982
- **Registered in SAM**
- **ITAR Registered**
- **ISO 9001:2015 Certified**
- **AS9100 Compliant**
- **30,000 Square Feet of Manufacturing Space**
- **2018 sales:** \$11 million
- **95+ employees**
- **NAICS: 333314 SIC: 3231**



IRD Glass provides a comprehensive array of optical and technical glass fabrication services including: grinding, lapping, polishing, assembly, thin film coating, sawing, dicing, drilling, coring, machining, waterjet, Spinel and sapphire machining and polishing, precision stainless steel polishing, and heat/chemical strengthening. IRD delivers all of these services for custom ceramic components as well.

IRD Glass currently manufactures a multitude of precision components from both optical and technical glass, ceramic, sapphire and Spinel. These custom components include: Custom optical components for the Laser OEM market, sapphire windows and components, precision tubes and pedestals for the sensor and pressure transducer industry, Cylindrical and rod lenses, laser ring-gyro bodies for guidance systems, optical assemblies and sub-assemblies, prisms and optical wedges, thin-film optical coatings, high laser-damage mirrors, windows, reticles and flat lenses, spherical and aspherical lenses, and ultra-precision tooling and fixturing.

For over 36 years, IRD Glass has been driven by a partnership philosophy. This devoted effort has allowed them to maintain long-standing relationships with such World Class customers as Honeywell (31 years), CyberOptics (27 years) and Rockwell Collins (25 years). At IRD, they truly care about their partners, be it customers, vendors or employees.

Markets Served

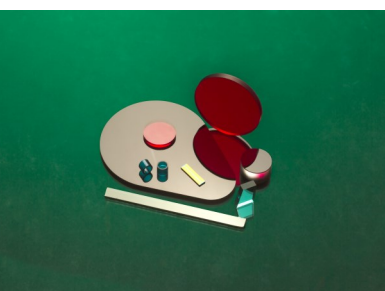
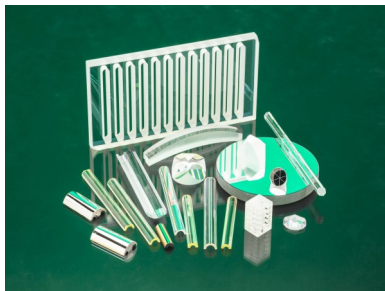
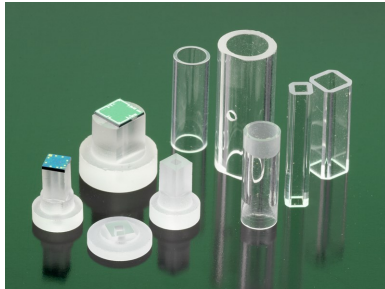
- **Laser OEM**
- **Precision Pressure Tubes and Pedestals**
- **Medical**
- **Sensor OEM**
- **Aerospace**
- **Technical Tooling and Fixturing**
- **Sapphire**
- **Defense and Homeland Security**
- **Machine Vision**
- **Inspection**

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Capabilities



	MACHINE		GRIND	
	Typical	Best	Typical	Best
Dimension	± .005"	± .001"	± .002"	± .0002"
Radius	± .005"	± .001"	± .005"	± .001"
Roughness	Ra 30 µin	Ra 10 µin	Ra 40 µin	Ra 10 µin
Flatness	± .005"	± .002"	± .001"	± .0002"
Parallel	± .005"	± .002"	± .001"	± .0002"
Max Size	30" x 16" x 16"		24" Diameter (10" ht)	

	LAP		POLISH	
	Typical	Best	Typical	Best
Radius (Cylinders)	± .002"	± .0005"	± .002"	± .0005"
Roughness	Ra < 10 µin	Ra < 5 µin	Ra < 1 µin	Ra < 5 Å
Angles	—	—	5 arc min	3 arc sec
Flatness	± .000050"	± .000010"	1 wave	< 1/20 wave
Parallel	± .000050"	± .000010"	30 arc sec	< 5 arc sec
Max Size	12" Diameter		12" Diameter	

	SAW		WATERJET	
	Typical	Best	Typical	Best
Dimension	± .005"	± .001"	± .010"	± .005"
Radius	—	—	± .010"	± .005"
Roughness	Ra 30 µin	Ra 10 µin	Ra 90 µin	Ra 60 µin
Flatness	± .005"	± .0005"	± .001"	± .0002"
Parallel	± .005"	± .0005"	± .001"	± .0002"
Max Size	14" x 8" x 1"		40" x 24" x 2"	

	DICE			
	Typical	Best		
Dimension	± .005"	± .0005"		
Roughness	Ra < 10 µin	Ra < 5 µin		
Flatness	—	—		
Parallel	± .000050"	± .000010"		
Max Size	8" Dia x .393" thick			

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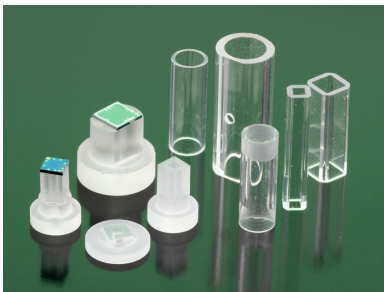


Core Competencies

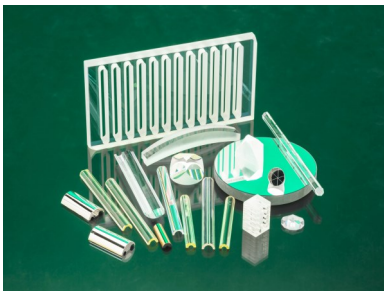
IRD Glass specializes in the manufacture of precision optical and technical glass and ceramic components made from a wide range of raw materials. IRD excels at holding precision tolerances to help their customers solve problems resulting from excessive variation. Due to their sincere partnership business style, IRD has become the sole-source provider to large and small corporations across the globe.



Custom Laser OEM Optics IRD currently manufactures custom laser reflectors, cylindrical lenses, rod lenses and precision mirrors in custom shapes and sizes, using metrology and proprietary polishing equipment and processes to ensure a precise surface finish.



Precision Tubes, Pedestals and Rods IRD currently manufactures multiple sizes of precision glass tubes and pedestals for the pressure transducer and sensor industries, along with other applications. They also manufacture high-precision glass and ceramic rods used as tooling, spacers or masks.



Sapphire IRD has expanded into sapphire processing, including precision machining, sawing, dicing and polishing.

Super Polish IRD Glass has super polish capabilities. Please see our capabilities insert for further details.

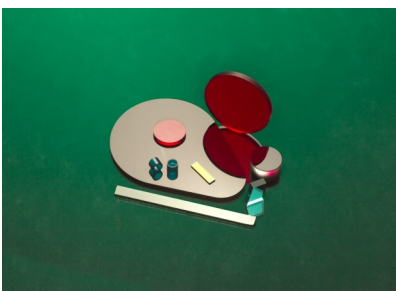
Flat Optics IRD manufactures laser mirrors, prisms, flats, certified optical wedges, optical filters, diffusers, vacuum plates and precision windows for many applications. They also make patterned masks and chrome on glass reticles.



Additional Services Numerous value-adding services are provided for the optical and technical glass industries, including simple and complex optical assemblies, custom thin-film coatings, laser damage and mirror coatings and quick prototype turnaround times.

Precision Machining IRD Glass manufactures many different sizes and shapes of ultra-precise optical and non-optical components using a variety of grinding equipment, including CNC mills, lathes, saws, dicing machines and waterjets.

Metrology Equipment IRD Glass incorporates an OGP vision system, Nikon autocollimator, Zygo NewView 7300 system, Zygo Veri-fire, Wyco laser interferometer with computer-generated holographic cylinder nulls, Zeiss O-Inspect CMM, a Nemarski polarizing scope and toolmaker's scopes among their many inspection tool options.



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Partner Testimonials

Partnership likely means different things to different people. But for over 30 years, to the many satisfied customers of IRD Glass, it always means responsiveness, problem solving and dependability.

“When I’m in the development phase of a project, the responsiveness of IRD Glass is a huge positive for me,” explained one manufacturing engineer. “We work closely with their engineers from product start-up through production, and any time we need something done, IRD Glass is able to turn things around quickly.”

Another engineer agreed, citing his own experience with a recent project. “In a recent design, IRD Glass was doing a flex designed filter glass component for us,” he explained. “We worked with IRD Glass to redesign the component, changing the shape, adding some chrome mesh and even multiple layers of coating to make the product just the way we needed it to be. When there was a problem in the design,” he added, “we could fix it and get things right the first time for production.”

For one purchasing agent, IRD Glass’ commitment to customer intimate solutions translates into dependability, whether that means quick turnaround in quoting, pricing or delivery. “I feel like when I need something,” she explained, “I can call IRD Glass and get it back to me quickly. They’re great to work with—very easy to work with. Of all our suppliers,” she added, “they provide me with probably the best communication.”

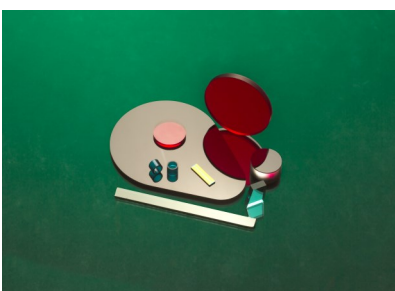
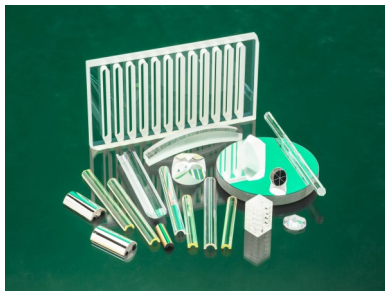
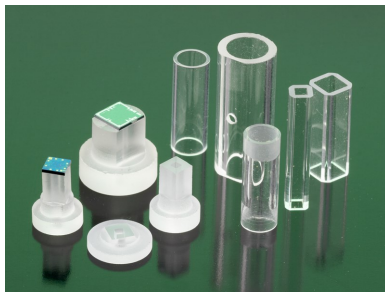
“We have a great relationship with them,” quoted another buyer. “When I call, the people at IRD Glass listen. I can get things turned around very quickly and efficiently. Whatever I need, whenever I need it,” she finished, “IRD Glass does their best to keep me satisfied.”

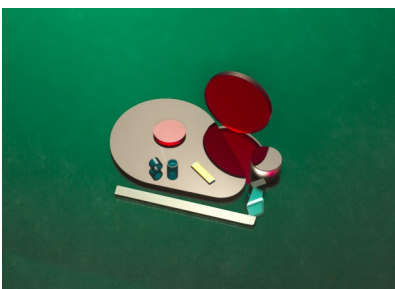
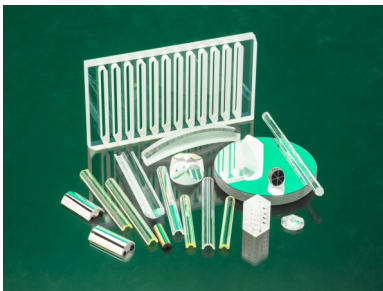
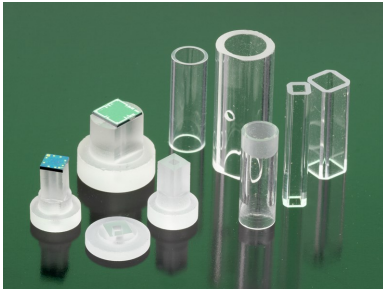
Satisfied customers agree; it’s IRD Glass’ commitment to listening and working together in partnership that sets the Minnesota-based manufacturer of precision glass components ahead of the competition.

For more information about IRD Glass or to learn how they can help with current designs or redesigns, call them at 320-693-7217, email them at ird@irdglass.com or visit their website at www.irdglass.com.

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Machining

- ◆ HAAS CNC VMC (6)
- ◆ Manual Mill (3)
- ◆ Matsura CNC VMC
- ◆ OMAX CNC Waterjet
- ◆ HAAS CNC Lathe

Grinding

- ◆ Blanchard Surface Grinder (16)
- ◆ DAMA edge beveler
- ◆ Hyundai 400G Lathe (2)
- ◆ KO Lee Cylindrical Grinder
- ◆ Landis Cylindrical Grinder
- ◆ Rod Grinder (2)
- ◆ Saeda Edge Grinder (2)
- ◆ Sidai Auto Optical Edger
- ◆ Mildex Bevel System

Sawing/Dicing

- ◆ Chevalier CNC Slicing Saw (3)
- ◆ Custom Diamond Saw (6)
- ◆ Disco Dicing System (2)
- ◆ K&S Dicing Saw
- ◆ KO Lee CNC Slicing Saw
- ◆ STC Annulus Saw (2)
- ◆ Accretech Dicing Saw
- ◆ Disco Laser Dicing system

Lapping

- ◆ LapMaster 9B DS Lap
- ◆ LapMaster SS Diamond Lapper 36"
- ◆ LapMaster SS Lapper 36" (2)
- ◆ PR Hoffman PR1-66T
- ◆ Speedfam 16B DS Lapper (2)

Polishing

- ◆ Cylindrical Polishing System (6)
- ◆ Fire Polisher (5)
- ◆ LapMaster 9B DS Polisher (2)
- ◆ LapMaster CP 48" (3)
- ◆ PR Hoffman PR1-66T
- ◆ Rod Polisher (11)
- ◆ Speedfam 16B DS Polisher (3)
- ◆ Speedfam CP Pitch 48"
- ◆ Speedfam CP 48"
- ◆ Strasbaugh CP 36" (2)
- ◆ Strasbaugh CP Diamond 30"

Metrology/Inspection

- ◆ CGH Cylinder Null (4)
- ◆ HEPA Clean Room (2)
- ◆ K&S Microwash Spin Station (2)
- ◆ Nikon 6D Interferometer
- ◆ Nikon Toolmaker Scope
- ◆ OGP CNC Vision Inspection System
- ◆ Starrett Easy View Toolmaker Scope
- ◆ Wyko 6000 PS Interferometer
- ◆ Ziess O-Inspect CMM
- ◆ Zygo 6" Verifire
- ◆ Zygo GPI Interferometer
- ◆ Zygo NewView 7300 Interferometer

Coating

- ◆ E-Beam Coating Chamber (2)
- ◆ DC Magnetron Sputtering Chamber

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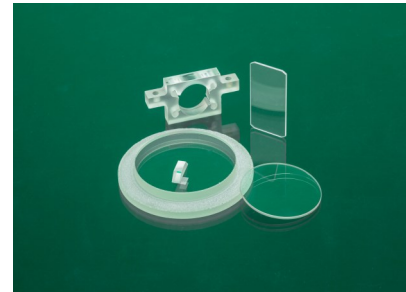
SAPPHIRE Window Stock Price List*

Stock windows ship next business day

Diam	Thick	Plane	Scratch/Dig	Flatness	Paralellism	1-20
25.4mm	1.0mm	C-axis	80/50	1 λ	3 arc min	\$ 50.00
25.4mm	1.0mm	C-axis	40/20	1/4 λ	10 arc sec	\$ 80.00
25.4mm	3.0mm	C-axis	80/50	1 λ	3 arc min	\$ 75.00
25.4mm	5.0mm	C-axis	80/50	1 λ	3 arc min	\$ 80.00
25.4mm	5.0mm	C-axis	40/20	1/4 λ	10 arc sec	\$ 125.00
50.8mm	3.0mm	C-axis	80/50	2 λ	3 arc min	\$ 170.00
50.8mm	3.0mm	C-axis	40/20	1/4 λ	10 arc sec	\$ 365.00
50.8mm	5.0mm	C-axis	80/50	2 λ	3 arc min	\$ 180.00
50.8mm	5.0mm	C-axis	40/20	1/4 λ	10 arc sec	\$ 375.00
31.75mm	1.0mm	Random	20/10	8 λ	3 arc min	\$ 75.00
31.75mm	1.0mm	Random	20/10	1/2 λ	10 arc sec	\$ 100.00
38mm	1.5mm	C-axis	80/50	2 λ	3 arc min	\$ 95.00

*other sizes and configurations/specifications always available upon request.

Quick turns on hundreds of other sizes



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