Au

Gold Mirrors

🟡 Key Properties of Gold (Au)

✨ Exceptional Reflectivity: Over 95% reflectance across 0.7–20 µm — ideal for infrared and thermal applications.
🔥 High Thermal Conductivity: Efficiently dissipates heat, making it perfect for high-power laser and thermal control systems.
🧪 Chemically Inert: Non-oxidizing and non-tarnishing — maintains optical performance in harsh or humid environments.
🔍 Infrared Mirror Material: Commonly used as a reflective coating on substrates like germanium, fused silica, or aluminum.
🛡️ Durable Coatings: Often protected with SiO_2 or ZnS over-layers to increase scratch resistance and longevity.
⚙️ Soft but Stable: Gold is mechanically soft yet dimen sionally stable — suitable for precision optical coatings and mirrors.
🌡️ Broad Spectral Range: Highly reflective from the visible through far-infrared, ideal for spectroscopy, aerospace, and defense optics.

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🛠️ Applications of Gold (Au)

🪞 Infrared Mirrors and Reflective Optics: Used for high-efficiency mirrors and beam steering components in thermal imaging, spectroscopy, and laser systems due to its >95% IR reflectivity.
⚙️ Laser and High-Power Systems: Applied as a durable reflective coating on substrates such as fused silica, germanium, and aluminum to handle intense laser and thermal loads.
🛰️ Aerospace and Defense Optics: Ideal for harsh environments where chemical inertness, long-term stability, and minimal oxidation are essential.
🔬 Spectroscopy and Scientific Instruments: Used in optical filters, detectors, and reflective elements for mid- to far-infrared laboratory equipment.
💡 Thermal Management and Energy Systems: Utilized in applications requiring low emissivity and high thermal conductivity to reflect or control infrared radiation.
🧪 Coating Technology and Thin Films: Gold coatings enhance infrared performance and durability when combined with protective over-layers like SiO_2 or ZnS.

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Technical Parameters of Gold Mirrors (Au)

Property	Typical Value
Reflectivity Range	~0.7 µm to 20 µm (visible to far-infrared)
Infrared Reflectivity	>95% across 1–20 µm
Refractive Index (n)	~0.47 @ 10 µm (metallic)
Extinction Coefficient (k)	~35 @ 10 µm
Density	19.32 g/cm³
Melting Point	1,064 °C
Thermal Conductivity	~315 W/m·K @ 300 K
Coefficient of Thermal Expansion	14.2×10^{-6} /°C @ 25 °C
Electrical Conductivity	~45.2×10^{6} S/m
Chemical Stability	Chemically inert — does not oxidize or tarnish
Form	Thin-film coating, mirror substrate, or evaporated layer
Substrate Compatibility	Fused silica, germanium, aluminum, copper, silicon
Protective Overcoats	SiO_2, ZnS, or DLC for enhanced durability and adhesion
Applications	Infrared mirrors, thermal imaging, spectroscopy, aerospace, and high-power laser optics

Gold (Au) is a highly reflective, noble metal coating used extensively for infrared mirrors, laser optics, and thermal imaging systems.
It provides exceptional reflectivity (>95%) from 0.7 µm to over 20 µm, covering the entire mid- and far-infrared spectrum.

Gold is chemically inert, thermally stable, and non-oxidizing, making it ideal for use in harsh or high-temperature environments such as aerospace, spectroscopy, and defense applications.
When deposited on substrates like fused silica, germanium, or aluminum, gold produces durable, low-emissivity mirrors with superior performance in IR beam steering, collimation, and energy management systems.

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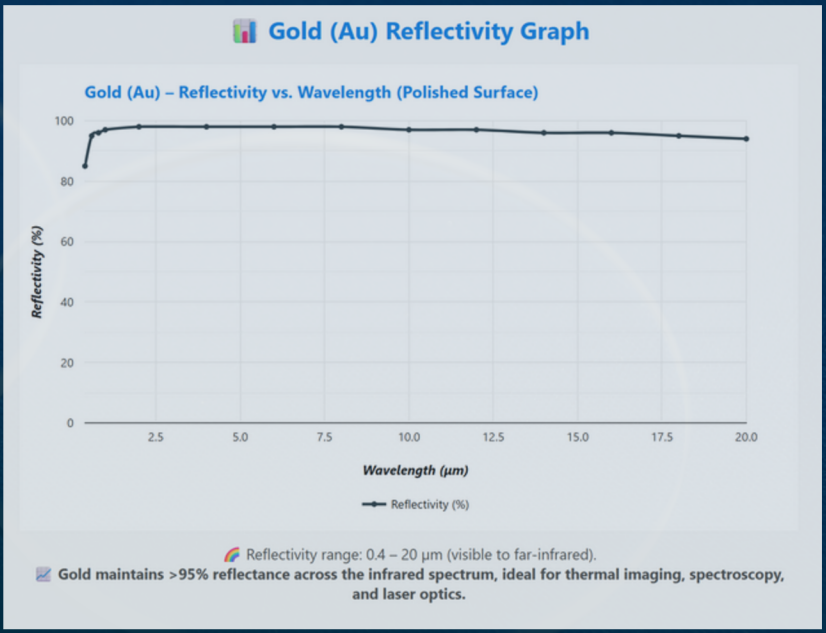
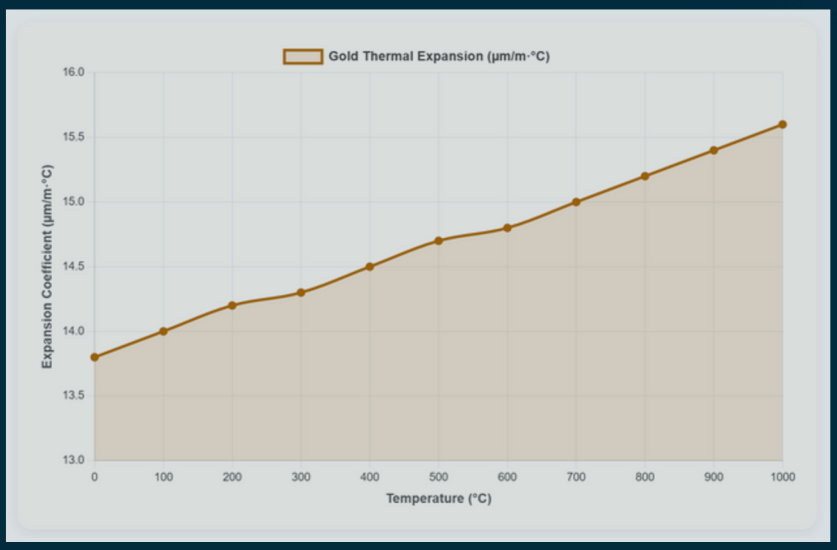
Reflectance:
Gold (Au) provides exceptionally high reflectance across the infrared spectrum, typically exceeding 95% from 0.7 µm to beyond 20 µm.
It is highly efficient in both the mid-wave (MWIR) and long-wave (LWIR) infrared regions, making it ideal for thermal imaging, spectroscopy, and laser systems.
Unlike silver or aluminum, Gold maintains its reflective performance under harsh environmental conditions and does not oxidize, ensuring long-term optical stability for precision mirrors, beam steering systems, and infrared instruments.





Thermal Stability:
Gold is thermally and chemically stable, with excellent resistance to oxidation and corrosion even at elevated temperatures.
Its low emissivity (~0.02–0.05) and high thermal conductivity (~317 W/m·K) make it ideal for high-power laser and thermal control applications, where efficient heat dissipation is essential.
Although Gold is mechanically soft, protected coatings with over-layers such as SiO_2, ZnS, or MgF_2 enhance durability without compromising infrared performance.
These properties make Gold mirrors a preferred choice for aerospace, defense, and high-temperature optical systems requiring consistent reflectivity and thermal reliability.

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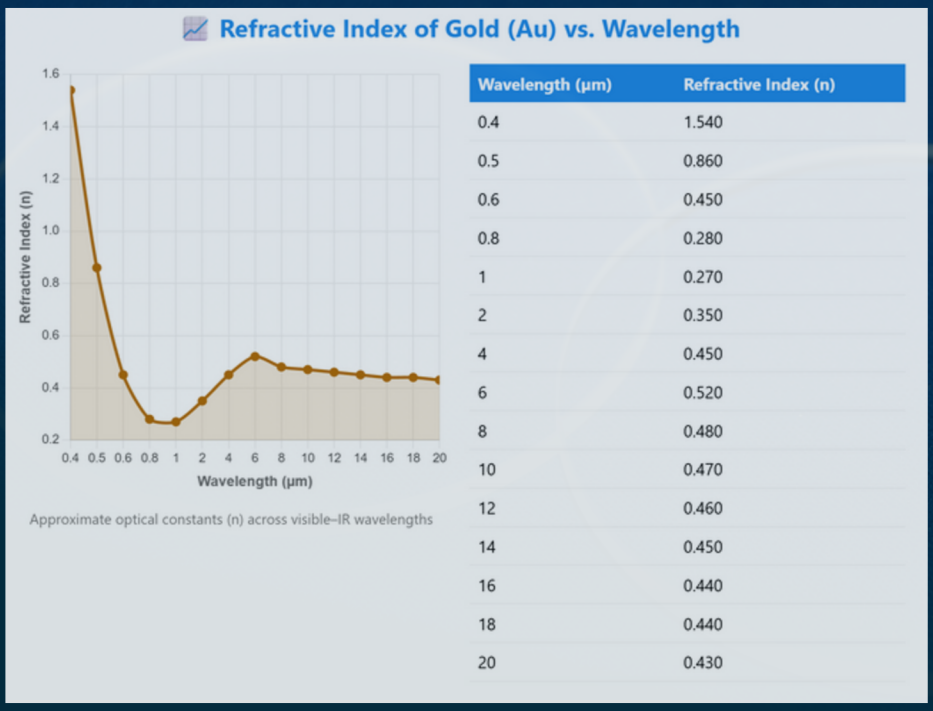

Approximate optical constants (n) across visible–IR wavelengths

Wavelength (µm)	Refractive Index (n)
0.4	1.540
0.5	0.860
0.6	0.450
0.8	0.280
1	0.270
2	0.350
4	0.450
6	0.520
8	0.480
10	0.470
12	0.460
14	0.450
16	0.440
18	0.440
20	0.430

FAQ

: What are Gold mirrors used for?
A: Gold (Au) mirrors are widely used in infrared (IR), laser, and thermal imaging systems due to their high reflectivity across 0.7–20 µm. They are ideal for beam steering, collimation, spectroscopy, and heat management in industrial, aerospace, and defense applications. Gold coatings are also commonly used on substrates such as fused silica, germanium, and aluminum for high-efficiency IR optics.

Q: Why is Gold used for infrared mirrors?
A: Gold is one of the most reflective materials in the infrared spectrum, maintaining >95% reflectance from 0.7 µm to over 20 µm. It also has low emissivity and excellent thermal and chemical stability, making it ideal for high-power laser optics and thermal control systems where minimal absorption and heat buildup are critical.

Q: How durable are Gold coatings?
A: While pure Gold is soft, optical mirrors typically include a thin protective overcoat (e.g., SiO_2, ZnS, or MgF_2) to prevent scratching or tarnishing. These protected gold mirrors combine excellent durability with long-term reflectivity, even in humid or outdoor environments.

Q: Can Gold mirrors be used with visible light?
A: Gold strongly absorbs visible wavelengths, giving it its characteristic yellow color. It is not suitable for broadband visible applications, but performs exceptionally well in the infrared. For visible mirrors, silver or aluminum coatings are generally preferred.

Q: What substrates can Gold be coated on?
A: Gold coatings can be applied to a wide range of optical materials, including fused silica, BK7, germanium, aluminum, and silicon. The substrate is chosen based on thermal, mechanical, and wavelength requirements — for example, fused silica for broadband reflectors, or germanium for IR beam splitters.

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