

August 05, 2026



Growth Method	CVD
Chemical Vapor Deposition (CVD)	Highly controlled environment, allowing precise control over growth parameters like temperature, pressure, and gas composition.
Molecular Beam Epitaxy (MBE)	Ultra-high vacuum conditions, enabling atomic-level precision in layer-by-layer growth.
Sputtering	Vacuum-based process where atoms are ejected from a target material and deposit onto a substrate.
Pulsed Laser Deposition (PLD)	High-energy laser pulses evaporate material from a target, creating a plasma plume that deposits film.
Atomic Layer Deposition (ALD)	Self-limiting surface reactions alternating between different precursors to achieve atomic-scale thickness control.
Electrochemical Deposition (ECD)	Growth occurs on a conductive substrate through an electrolyte solution under an applied potential.
Sol-gel Process	Involves sol formation followed by gelation and subsequent drying/curing to form a solid film.
Hydrothermal Synthesis	Growth occurs in aqueous solutions at elevated temperatures and pressures, often yielding nanostructures.
Langmuir-Blodgett (LB) Technique	Monolayers of molecules are first formed at an air-water interface and then transferred to a solid substrate.
Dip Coating	The substrate is simply dipped into a liquid precursor solution, followed by withdrawal and drying.
Spin Coating	A small volume of liquid is spread uniformly across the substrate by rapid rotation.
Drop Casting	Liquid droplets are manually deposited onto the substrate and allowed to dry.
Layer-by-Layer Assembly (LbL)	Alternating deposition of different materials or functional groups to build up multilayers.
Self-Assembly	Natural tendency of certain molecules or nanoparticles to organize themselves into ordered structures.
Bio-inspired Growth	Mimicking biological processes, such as mineralization, to grow structured materials.
Epitaxial Growth	Growing a new crystal phase on top of a pre-existing crystalline substrate, maintaining lattice continuity.
Heteroepitaxy	Growing a material with a different crystal structure than the substrate.
Isotactic Epitaxy	Growing a material with the same crystal structure as the substrate.
Strain Engineering	Controlling the mechanical stress/tension during growth to tune material properties.
Defect Engineering	Intentionally introducing defects (vacancies, interstitials, dislocations) during growth to modify electronic/optical behavior.
Surface Functionalization	Modifying the surface chemistry of the growing film to enhance adhesion or specific interactions.
Interface Control	Managing the interaction between the growing layer and the underlying substrate.
Template-Assisted Growth	Using porous templates or nanowire arrays to guide the morphology and orientation of the grown material.
Seed-Mediated Growth	Initiating growth on pre-deposited seed layers to improve uniformity or nucleation density.
Controlled Nucleation	Manipulating the initial stage of growth to dictate the number and location of nuclei.
Annealing Post-Growth	Heat treatment after growth to relieve stresses, improve crystallinity, or induce phase transformations.
Post-Synthesis Modification	Chemically treating the grown material to alter its surface properties or bulk composition.
Transfer Printing	Transferring pre-grown films or patterns from one substrate to another using elastomeric stamps.
Roll-to-Roll Processing	Continuous manufacturing technique suitable for large-area production of thin films.
Atomic Scale Manipulation	Direct manipulation of individual atoms or molecules on a surface using techniques like STM.
Biological Mineralization	Exploiting natural biological pathways involving enzymes and organic matrices to grow minerals.
Microfluidic Synthesis	Performing synthesis reactions in precisely controlled microchannels for uniform, small-scale growth.
Photodeposition	Using light irradiation to initiate the deposition reaction from a precursor solution.
Thermal Evaporation	Heating a source material until it vaporizes and deposits onto a nearby cold substrate.
E-beam Evaporation	Using a focused electron beam to heat and evaporate the source material.
Physical Vapor Deposition (PVD)	General term encompassing evaporation and sputtering processes.
Ion Sputtering	Using energetic ions to bombard a target, ejecting particles which then deposit elsewhere.
Radiation-Induced Polymerization	Using ionizing radiation to cross-link monomers and form polymer films.
Photoinduced Phase Transition	Using light to trigger a structural change in a material, potentially leading to self-organization.
Electrochromic Deposition	Combining electrochemical deposition with optical absorption to create functional films.
Thermally Induced Self-Organization	Controlling molecular assembly through temperature changes.
Supercritical Fluid Assisted Growth	Utilizing supercritical fluids (like CO ₂) to facilitate unique growth environments and morphologies.
Interfacial Reaction	Growth occurring directly at the boundary between two different phases or materials.
Diffusion-Controlled Growth	Growth rate limited by the transport of reactants through a medium or barrier.
Kinetic Control	Controlling the growth process based on understanding the reaction kinetics.
Thermodynamic Control	Controlling the growth process based on understanding the equilibrium states and free energy landscape.
Phase Separation	Exploiting immiscibility between components to drive the formation of distinct domains or structures.
Directed Self-Assembly	Combining self-assembly with external cues (templates, fields) to direct the final structure.
Bottom-Up Approach	Building complex structures from simple building blocks (atoms, molecules, nanoparticles).
Top-Down Approach	Starting with a larger material and patterning or etching it down to the desired structure.
Hybrid Approaches	Combining elements of both bottom-up and top-down strategies.
Computational Modeling	Using simulations to predict growth outcomes and optimize experimental parameters.
Machine Learning Optimization	Applying ML algorithms to analyze growth data and suggest optimal synthesis conditions.
Real-time Monitoring	Employing techniques like ellipsometry or spectroscopy during growth to track progress.
Feedback Control	Adjusting growth parameters dynamically based on real-time monitoring data.
Scalability Considerations	Evaluating the feasibility of translating laboratory growth methods into industrial-scale production.
Material Characterization	Using various analytical tools (XRD, SEM, TEM, etc.) to verify the quality and structure of the grown material.
Property Measurement	Characterizing the electrical, optical, mechanical, and thermal properties of the synthesized material.
Device Integration	Assessing how well the grown material integrates with other components for functional devices.
Reproducibility Studies	Ensuring consistent results across multiple trials and independent research groups.
Stability Testing	Evaluating the long-term performance and degradation resistance of the grown material.
Environmental Impact Assessment	Considering the sustainability and safety aspects of the growth process and materials used.
Cost Analysis	Evaluating the economic viability of the growth method for commercial applications.
Regulatory Compliance	Adhering to relevant standards and regulations governing material synthesis and processing.
Collaborative Research	Engaging multiple experts and institutions to tackle complex challenges in growth science.
Open Access Data Sharing	Facilitating transparency and accelerating discovery by sharing experimental results publicly.
Industry-Academia Partnerships	Fostering collaboration between fundamental research and practical application development.
Talent Development	Investing in training the next generation of researchers and engineers in growth technologies.
Public Outreach	Communicating the significance and progress of growth science to the broader community.
Ethical Considerations	Reflecting on the societal implications and responsible use of emerging growth technologies.
Future Prospects	Identifying emerging trends and potential breakthroughs in the field of material growth.

© GCAL USA LLC. All rights reserved.

Ultimate Diamond Cut Grade



P Poor **F** Fair **G** Good **VG** Very Good **EX** Excellent

Technical drawing of a diamond showing its proportions and dimensions. The drawing includes the following measurements:

- Table width: 7.48mm
- Table length: 4.57mm
- Table percentage: 61%
- Table thickness: 0.30mm
- Table percentage: 4.0%
- Table angle: 33.5°
- Table depth: 4.57mm
- Table percentage: 61.0%
- Table angle: 40.6°
- Table depth: 0.03mm
- Table percentage: 0.4%
- Table depth: 0.97mm
- Table percentage: 13.0%
- Table depth: 3.30mm
- Table percentage: 44.0%

DIAMOND SHAPES



CARAT WEIGHT SIZES

Carat Weight	2.50	2.00	1.50	1.00	0.75	0.50
Approx. Size						
Diameter	8.60mm	8.00mm	7.30mm	6.40mm	5.80mm	5.10mm

DIAMOND CLARITY GRADING SCALE

FL	IF	VVS1	VVS2	VS1	VS2	S11	S12	I1	I2	I3
FLAWLESS - INTERNALLY FL.		VERY VERY SLIGHTLY INCLUDED		VERY SLIGHTLY INCLUDED		SLIGHTLY INCLUDED		INCLUDED/PIQUE		

DIAMOND COLOR GRADING SCALE



D - Z DIAMOND COLOR GRADING SCALE

DIAMOND FLUORESCENCE GRADING SCALE



DIAMOND POLISH & SYMMETRY GRADING SCALE

EXCELLENT	VERY GOOD	GOOD	FAIR	POOR
-----------	-----------	------	------	------

BRILLIANT CUT DIAGRAM



BUY WITH
CONFIDENCE

GCAL BY SARINE™
4Cs GRADING GUARANTEE

The GCAL by Sarine™ philosophy is simple: we believe consumers should feel confident about their lab grown diamond purchase, in the same way we believe experts should be accountable and stand behind their work.

This is why your lab grown diamond is protected by a zero tolerance, money-backed grading guarantee. You should know that the GCAL by Sarine™ 4Cs Grading Certificate is the only 4Cs grading certificate in the world that comes with a guarantee that ensures the accuracy of the certified lab grown diamonds' weight and quality grades. If the carat weight or any of the cut, color, or clarity grades provided in this GCAL by Sarine™ 4Cs Grading Certificate is lower than the weight or quality grade of your certified lab grown diamond, GCAL by Sarine™ will reimburse you the difference between what you paid for the lab grown diamond and the current fair value of an equivalent lab grown diamond in the market in which it was purchased, pursuant to the newly established grades. Kindly see additional details, including the limitations of the guarantee, at [GCALUSA.com](https://www.gcalusa.com).

MISSION STATEMENT

To provide the most accurate and consistent gemological grading, with uncompromising integrity and unparalleled customer service.

GEMPRINT®

Having a traceable, unique “fingerprint” of your lab grown diamond adds future protection to your investment, as well as peace of mind. GCAL by Sarine™ records the distinctive Gemprint of every diamond we certify. This patented technology for positive identification is recognized worldwide as forensic evidence and identification. Register your lab grown diamond at [GEMPRINT.com](https://www.gemprint.com)

CERTIFICATE VERIFICATION

You can verify the authenticity of this certificate by entering your GCAL by Sarine™ Certificate Number at [GCALUSA.com](https://www.gcalusa.com). You can also download a complimentary digital copy of this document to send to your insurance company.



GUARANTEED
CERTIFICATE



LAB GROWN



8X® is the highest achievement in precision diamond cutting. The **GCAL 8X** Ultimate Diamond Cut Grading System encompasses all aspects of diamond CUT quality assessment. Your lab Grown diamond has achieved grades of Excellent in all eight aspects of CUT quality assessment. As a result, this lab grown diamond is recognized for its extraordinary brilliance and beauty.

PHYSICAL EXCELLENCE

The first three of the 8X grading factors analyze the exactness of the physical surface, the facet shapes, as well as the angles. This includes the Polish, External Symmetry and Proportions.

Decades of meticulous mathematical calculations have determined the narrow proportion ranges required to produce superior cut diamonds. Each shape has been studied individually to find the most aesthetically pleasing parameters. Some of the factors considered are listed below.

To view the proportions specifications for each shape, please visit our website [GCALUSA.COM](https://www.gcalusa.com)

Table %	Lower Girdle Facet Length
Depth %	Star Length
Crown Angle/Height	Girdle Thickness
Pavilion Angle/Height	Culet Size

LIGHT PERFORMANCE EXCELLENCE

The next three of the 8X grading factors are Brilliance, Fire and Scintillation, which analyze the light handling ability of your lab grown diamond. The combination of these factors is the essence of what makes any diamond visibly shine, dance and sparkle from across a room. Fire and Scintillation are graded while the diamond is in motion and interacting with light. View the Fire and Scintillation videos of this lab grown diamond at [GCALUSA.com](https://www.gcalusa.com) or by scanning the QR code on this certificate.

OPTICAL EXCELLENCE

The last two 8X grading factors consider optical excellence. These factors scrutinize the craftsmanship, the precise alignment of the crown and pavilion facets, the shape outline, and the length to width ratio, ensuring the lab grown diamond achieves aesthetic perfection.

Grading scales for each of the 8X grading factors can be viewed at [GCALUSA.com](https://www.gcalusa.com)

Independently Graded and Guaranteed by GCAL by Sarine™