



Lab-Grown Diamonds

For Prelims: Lab-Grown Diamonds, Natural Diamonds, High-Pressure High Temperature (HPHT) method, Chemical Vapour Deposition (CVD) method.

For Mains: Lab-Grown Diamonds, Diamond Industry in India, Production Methods of Lab-Grown Diamonds.

[Source: TH](#)

Why in News?

[Lab-grown diamonds](#) (LGDs), also known as synthetic diamonds have emerged as a disruptive force in the traditional diamond market.

- These gems are created in laboratories using advanced techniques, mimicking the natural processes that form **diamonds deep within the Earth**.

What are Laboratory-Grown Diamonds?

▪ About:

- LGDs are manufactured in laboratories, as opposed to naturally occurring diamonds. However, the chemical composition and other physical and optical properties of the two are the same.
- Naturally occurring diamonds take millions of years to form; they are created when carbon deposits buried within the earth are exposed to extreme heat and pressure.

▪ Manufacturing:

- They are mostly manufactured through two processes, **High Pressure High Temperature (HPHT) method** or **Chemical Vapour Deposition (CVD) method**.
- Both HPHT and CVD methods of growing diamonds artificially begin with a seed, a slice of another diamond.
 - In the HPHT method, the seed, along with **pure graphite carbon, is exposed to temperatures around 1,500 degrees Celsius** and extremely high pressure.
 - In the **CVD method**, the **seed is heated to around 800 degrees Celsius** inside a sealed chamber filled with a carbon-rich gas. The gas sticks to the seed, gradually building the diamond.

▪ Applications:




- They are used for industrial purposes in machines and tools and their hardness and extra strength make them **ideal for use as cutters**.
- Pure synthetic diamonds are used **in electronics as a heat spreader** for high-power laser diodes, laser arrays and high-power transistors.
- They are also used for **luxurious and aesthetic purposes**.

▪ Significance:

- The **environmental footprint** of a diamond grown in a laboratory **is much lesser** than

that of a naturally occurring diamond.

- According to a report by Diamond Foundry, an environmentally conscious LGD manufacturer, **it takes ten times more energy to extract a natural diamond** from the earth than it takes in creating one above the ground.
- **Open-pit mining**, one of the most common methods of mining naturally occurring diamonds, **involves moving tonnes of earth and rock to extract these precious stones.**

Growth Process	Typical Growth Morphology
Natural	 Shape: Octahedron Growth: 8 directions
High Pressure, High Temperature (HPHT)	 Shape: Cuboctahedron Growth: 14 directions
Chemical Vapor Deposition (CVD)	 Shape: Cube Growth: 1 direction



What is the Scenario of Lab-Grown Diamonds in India?

- **Surat: The Hub of Diamond Cutting and Polishing**
 - **Surat** plays a pivotal role in the global diamond trade. Approximately **90% of the world's diamonds are cut and polished in Surat.**
- **The Rise of Lab-Grown Diamond Exports from India**
 - Between 2019 and 2022, lab-grown diamond exports **from India tripled in value.**
 - Export volumes rose by **25% between April and October 2023**, up from 15% in the same period a year earlier.
 - Lab-grown diamonds are gaining popularity globally due to their **affordability and ethical appeal.**
 - Lab-grown diamonds are called "**blood-free diamonds**" because they guarantee no violence and no human rights abuse.
- **Market Share and Industry Impact:**
 - The global market share of lab-grown gems surged from **3.5% in 2018 to 18.5% in 2023.**
 - Industry analysts predict that this share will likely exceed 20% in the year 2024-25.
 - This growth has added pressure to an industry already grappling with geopolitical challenges and **declining demand for natural diamonds.**

Note: Major Diamond Producing Countries: Russia, Botswana, Canada, South Africa, and the Democratic Republic of the Congo.

- **Russia is the world's largest producer** of rough diamonds, mining nearly 42 million carats in 2022.

What are the Ethical Concerns Related to Natural Diamonds?

- **Blood Diamonds (Conflict Diamonds):**
 - Some **natural diamonds are mined in conflict zones**. Such diamonds are called blood diamonds or **conflict diamonds**.
 - The profits generated from selling these diamonds are used for unethical reasons. They are used to **finance armed conflicts**. These diamonds are also associated with **human rights abuses**. It has led to the suffering of countless individuals in affected areas..
- **Exploitation and Labour Conditions:**
 - In some cases, workers in natural diamond mines endure poor working conditions, **low wages, and a lack of job security**.
 - This exploitation is a social issue that has attracted significant attention.
 - **Child labor is a concern in some regions** where diamonds are mined.
- **Environmental Impact:**
 - Natural diamond mining is notorious for its environmental consequences.
 - Large-scale open-pit mines can result in **deforestation, soil erosion, and much more**.
 - These practices also result in the release of harmful chemicals into local ecosystems. This not only affects the environment but also the **livelihoods of nearby communities**.
 - **Man-made diamonds are considered more environmentally friendly** because they significantly reduce the need for destructive mining practices.
- **Money Laundering and Corruption:**
 - The diamond trade has been linked to **money laundering and corruption**, which undermines social and economic development in diamond-producing countries. Combating these issues requires greater transparency, accountability, and anti-corruption measures.

What is the Kimberley Process Certification Scheme (KPCS)?

- **About:**
 - The Kimberley Process Certification Scheme (KPCS) is an important global initiative established in 2003 to **prevent the trade of conflict diamonds from infiltrating the mainstream rough diamond market**.
 - The KPCS ensures that rough diamonds in the legitimate supply chain are **KP (Kimberley Process)-compliant**.
 - It is enforced individually by **KP Participant countries**.
 - Through the KPCS, States implement safeguards on shipments of rough diamonds and certify them as “conflict-free”.
 - The KPCS was established by the [United Nations General Assembly](#) Resolution 55/56 following recommendations in the **Fowler Report**.
- **Key Facts about the KPCS:**
 - There are **59 participants representing 85 countries** around the world participating in the KP.
 - The KP observers include the **World Diamond Council**, representing the diamond industry.
 - Since 2003, India has been actively participating in the KPCS process and is a member of almost all Working Groups of KP (except the Working Group on Artisanal and Alluvial Production (WGAAP)).
 - The **Department of Commerce is the nodal Department**, and
 - Gem & Jewellery Export Promotion Council (GJEPC) is designated as the KPCS Importing and Exporting Authority in India.
 - GJEPC is responsible for issuing KP Certificates and is also the custodian of KP Certificates received in the country.

What are the Government Initiatives to Promote Lab-Grown Diamond?

▪ Five-Year Research Grant:

- In the **Union Budget 2023-24**, the government announced a five-year research grant for one of the [Indian Institutes of Technology \(IITs\)](#). The grant aims to encourage the indigenous production of LGD machinery, seeds, and recipes.
- The project has been assigned to **IIT Madras**, and an **India Centre for Lab-Grown Diamond (InCent-LGD)** is proposed to be established there.
 - The goal is to provide technical assistance to industries and entrepreneurs, promote indigenous manufacturing of both **Chemical Vapour Deposition (CVD) and High Pressure and High Temperature (HPHT) systems**, and expand the LGD business.

▪ Customs Duty Reduction:

- The government has **reduced the customs duty on lab-grown diamond seeds** to lower the cost of production and encourage the growth of lab-grown diamonds. This reduction aims to reduce import dependency and foster domestic production.
 - The **duty on seeds for rough LGDs has been reduced from 5% to nil.**

▪ New Tariff for Synthetic Diamonds:

- The government has taken a significant step by proposing the creation of new tariff lines. These lines will aid in better identification of various products, including synthetic diamonds.
- The primary objectives behind this move are to facilitate trade and provide clarity regarding the eligibility for concessional import duty. By creating specific tariff lines, the government aims to streamline processes and enhance transparency in trade-related matters.

Conclusion

- Lab-grown diamonds are not just a trend; they represent a fundamental shift in the diamond industry.
- As technology advances and consumer awareness grows, these sparkling gems continue to redefine the way we perceive and purchase diamonds.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q. Which one of the following foreign travellers elaborately discussed about diamonds and diamond mines of India? (2018)

- (a) Francois Bernier
- (b) Jean-Baptiste Tavernier
- (c) Jean de Thevenot
- (d) Abbe Barthelemy Carre

Ans: (b)

Mains:

Q. Discuss the multi-dimensional implications of uneven distribution of mineral oil in the world. (2021)

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