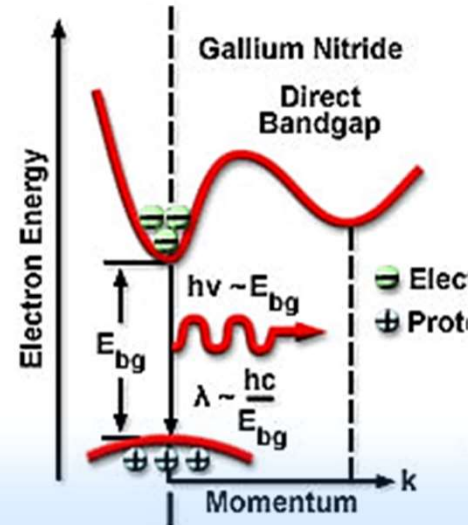


Solid state lighting (Example: LED)



Invention of the First Practical LED

*In 1962, while working at General Electric, **Nick Holonyak Jr.** invented the first practical visible-spectrum LED.*

*This breakthrough device emitted **red light** and laid the groundwork for the development of other LEDs that could emit light across the visible spectrum.*



Nick Holonyak
Syracuse, NY

@RCA Laboratories, Princeton, USA 1968-1974



chance to cross the goal line. ----H. Paul Maruska, 2015

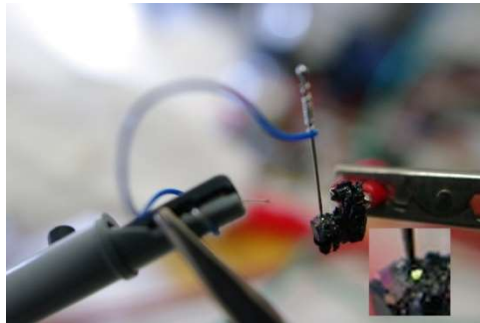
James J. Tietjen
Director of the Materials Research
Division, RCA Lab

LED: Early pioneers

(2 June 1881 – 17 August 1966)



Captain Henry Joseph Round
British Telecom Engineer, Personal assistant to Guglielmo Marconi.



H. J. Round: Electroluminescence from a point contact with a carborundum (SiC) 1907

➤ **Accidental discovery**

A Forgotten Hero



Oleg Vladimirovich Losev, 1903–1942.

- **A young and extremely talented scientist who spent his working life as a technician in several Soviet radio laboratories.**
- **Had no formal education but during the span of his short research career he published 43 papers in leading Russian, British and German research journals and was granted 16 patents.**
- **Eventually Died of hunger in 1942 during the blockade of Leningrad (870 days!!), at the age of 39.**
- **On his way to invent 3 terminal device!!**

Nikolay Zheludev, *Nature Photonics*, **1**, 189 (2007)

History of GaN Blue LED



Journal of Luminescence

Volume 5, Issue 1, March 1972, Pages 84-86

Letter to the editor

GaN blue light-emitting diodes

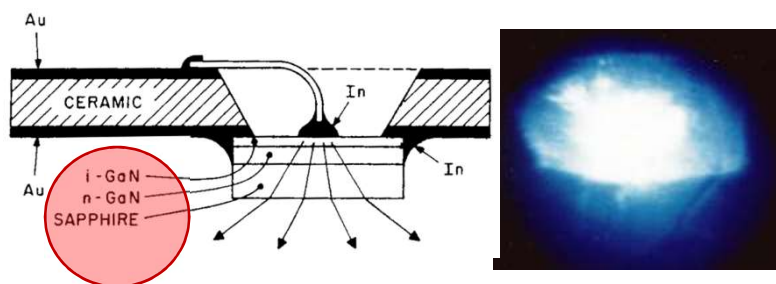
J.I. Pankove, E.A. Miller, J.E. Berkeyheiser

Show more

[https://doi.org/10.1016/0022-2313\(72\)90038-5](https://doi.org/10.1016/0022-2313(72)90038-5)

*RCA Laboratories,
Princeton, New
Jersey, U.S.A.*

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p-GaN could not be grown

First GaN LED (MIS type) Efficiency : $10^{-5} \sim 3 \times 10^{-4}$

- Entire program on GaN in was shutdown
- All GaN related activities in the US were abandoned
- No papers on this area until from Akasaki group in 1986 (Amano et al. Appl. Phys. Lett. 48, 353 (1986))
- Prof. Akasaki was only one still pursuing GaN work



Amano

Akasaki

History of GaN Blue LED



**36 years old
engineer without
PhD enters 1990**

Shuji Nakamura from Nichia Chemical

- **World first commercial LED was demonstrated in Nichia Chemical in 1993 by Shuji Nakamura**

Professor Nakamura succeeded in developing a high-brightness GaN/InGaN blue LED and released the world's first bright blue LED in 1993.

An innovation driven by Anger!!

Forbes: How do you become one of the world's greatest living inventors?

Shuji Nakamura: By being *"always angry."*

Nobel Prize in Physics 2014



Their dedication and perseverance finally paid off.

Isamu Akasaki, Hiroshi Amano and Shuji Nakamura won 2014 Nobel Prize in Physics

Where does India get import the LED chip from?

- According to recent data, the total imports of semiconductor chips surged by **92% from ₹67,497 crore in the fiscal year 2020-21 to ₹129,703 crore in 2022-23**. Most of these imports **come from China, which accounted for ₹37,681 crore of the total in 2022-23** ([ITIF](#)) ([CEOInsights India](#)).
- As per Volza's India Import data, Led chips import shipments in India stood at 126.8K, imported by 2,418 [India Importers](#) from 2,219 [Suppliers](#).
- India imports most of its Led chips from [China](#), [Vietnam](#) and [South Korea](#) and is the largest importer of Led chips in the World.
- The top 3 importers of Led chips are [India](#) with 126,837 shipments followed by [Vietnam](#) with 77,984 and [Peru](#) at the 3rd spot with 4,550 shipments.