GaN

- Early 1990s (re-emerged)
- promising material for both optical & μWave high power electronic applications.

- CAGR of commercial growth is ~ 50%.

because of its promise in —

a) RF application
b) wireless charging
c) electric vehicle

First synthesized in 1930 by Juza & Hahn by passing NH_3 over liquid Ga at high temp. 450-600°C

In 1968 GaN was grown on sapphire substrate.

over 900°C a monocrystalline GaN was formed with very high $n_0 \sim 10^{20}$/cc. without any doping.

First GaN based LED was produced in 1971 (GaN:Zn)

Later (GaN:Mg)

1989 - conductive p-type GaN films were produced
and this escalated the research in GaN

$Al_x Ga_{1-x} N$ / GaN heterostructure FETs were developed by 1994

	GaN	SiC	Diamond	Si	GaAs	InP
E_g	3.44	3.26	5.45	1.12	1.43	1.35
Elec. breakdown vol MV/cm	3	3	10	0.3	0.4	0.5
Saturated vel. of electrons	2.5×10^7 cm/s	2×10^7 cm/s	2.7×10^7 cm/s	1	1	1
Thermal conductivi W/cm.K	1.3 - 2.1	3.7-4.5	22	1.5	0.5	0.7
Dielectri const.	9	10.1	5.5	11.8	12.8	12.5
mobility	900	700	4800	1500	8500	5400

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Dielectric const is around 20% lower that gives an advantage over Si/GaAs that GaN device may have 20% larger area for the same impedence. Larger area enables the device to generate large current. Therefore GaN is suitable for μwave power in output.

Mobility is for high freq.
but mobility with thermal conductivity and electron breakdown voltage - combined makes the suitability for high power/high freq device.
where GaN takes over.