

氮化镓在射频电子中的应用：碳化硅基氮化镓 vs 硅基氮化镓？¹

截至2026年，氮化镓射频器件市场规模预期将达到24亿美元以上。碳化硅基氮化镓和硅基氮化镓之间的生产竞争开始浮现。

内容概览：

- 市场预测：
整个GAN² RF³市场的价值在2020年已达到8.91亿美元。
Yole Développement（Yole）称CAGR⁴₂₀₂₀₋₂₀₂₆为18%。
基于GaN的大型/小型蜂窝站点将在2026年占整个GaN电信基础设施市场的95%以上。
GaN RF器件市场将由5G电信基础设施和国防应用主导，截至2026年这两者在整个市场中所占份额将分别为41%和49%。
- 技术趋势：
碳化硅基氮化镓市场规模将从2020年的3.42亿美元增长到2026年的2.22亿美元，CAGR₂₀₂₀₋₂₀₂₆ 17%。
硅基氮化镓市场规模将从2020年的不到500万美元增长到2026年的1.73亿美元，CAGR₂₀₂₀₋₂₀₂₆ 86%。
在5G电信和国防领域的推动下，GaN-on-SiC⁵ 技术在高功率密度和导热性方面仍然更受青睐。
此类技术正在向6英寸工艺过渡，且预期将在未来几年内加快进程。
- 供应链：
以GaN-on-SiC技术为主导的垂直集成在国防和5G电信应用中一直都是更优的选择。

¹摘自：

《2021年GaN RF市场：应用、竞争厂商、技术和基板》报告，Yole Développement

²GaN：氮化镓

³RF：射频

⁴CAGR：年均复合增长率

⁵GaN-on-SiC：碳化硅基氮化镓

在国防领域，雷神公司，诺斯洛普·格鲁门公司和中国电子科技集团正引领GaN的采用。

值得关注的投资事件包括：Wolfspeed以10亿美元资本支出实现在2024年前扩大产能；恩智浦半导体于2020年在美国亚利桑那州开设了其首家6英寸晶圆厂；中国的山东天岳公司在上海投资新建一家6英寸工厂；以及高意集团在新泽西州新开的6英寸氮化镓晶圆厂。

“由于氮化镓射频市场的兴起，近年来一直有令人瞩目的投资在塑造未来的供需关系，这是需要密切关注的重要动向”，Yole Développement (Yole)功率与无线部下属的化合物半导体与新兴基板团队Ezgi Dogmus博士称。她补充道：“碳化硅基氮化镓是主要的技术平台。器件级别的市场领袖SEDI⁶已于领先的碳化硅晶圆供应商高意集团合作，进行垂直集成。”

在这样充满动态的形势下，Yole对技术与相关市场进行了深入调研。这家市场研究与战略咨询公司指明了最新的创新技术并突出重要商机。

今天发布的这份《2021年GaN RF市场：应用、竞争厂商、技术和基板》报告全面概括了氮化镓射频市场，涵盖市场和技术趋势：电信基础设施、手机、国防、卫星通信、射频能源和民用雷达。该报告概述了恩智浦半导体、Wolfspeed、山东天岳公司和高意集团等领先供应商的产能扩张和公司概况，并阐述了氮化镓相对LDMOS和砷化镓等其他竞争性技术的定位。这份研究报告包括市场趋势与预测、供应链、技术趋势、技术洞见与分析、要点总结和展望，它还特别介绍了碳化硅基氮化镓和硅基氮化镓这两种技术平台，包括其市场渗透水平，技术挑战和供应链等各方面。氮化镓射频产业中存在哪些经济与技术挑战？有哪些关键的驱动因素和相关应用？碳化硅基氮化镓 vs 硅基氮化镓：生产方面的情况如何？有哪些值得关注的供应商，他们正致力于开发什么创新技术？

Yole今天分享了其对氮化镓射频产业的见解与展望。

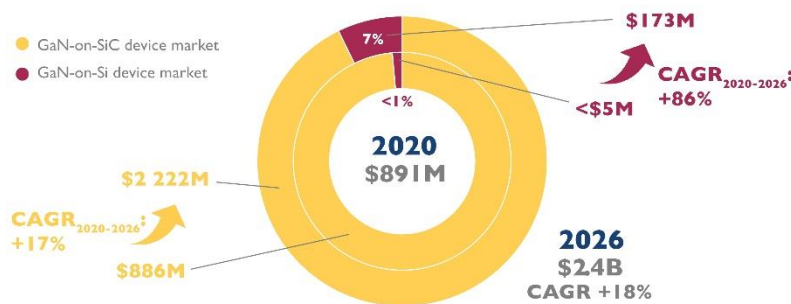
正如Yole团队在新发布的《2021年GaN RF市场：应用、竞争厂商、技术和基板》报告中所分析的那样，2020年，恩智浦半导体在美国亚利桑那州开设了全球第一家6英寸碳化硅基氮化镓晶圆厂。这些举措将进一步加速碳化硅基氮化镓从4英寸到6英寸的工艺演变。在代工厂层面，像穩懋半導體这样的主要厂商正在扩大产能，以满足不断增长的市场需求。此外，中国生态系统中有追求技术独立的强劲动力，例如在山东天岳公司、中国电子科技集团、成都海威华芯和三安光电这些企业就是如此。此外，硅基氮化镓产业还在不断吸引新的企业加入。

⁶SEDI: 住友电工

据Yole专门从事化合物半导体与新兴基板业务的技术与市场分析师Selsabil SEJIL博士称：“与此同时，随着Macom和意法半导体在6英寸平台上的合作开发继续进行，格芯和雷神公司也于最近宣布针对5G无线应用、国防及更多领域建立合作伙伴关系。新入局的厂商带着刚刚建立起来的技术能力加入这一产业，以服务不断增长的需求。”

2020-2026 packaged GaN RF device market forecast (\$M) - Split by technology platform

(Source: GaN RF Market: Applications, Players, Technology, and Substrates 2021 report, Yole Développement, 2021)



在氮化镓射频产业中，一切都始于碳化硅基氮化镓技术。碳化硅基氮化镓技术于20年前问世，如今已在射频功率应用领域成为LDMOS和砷化镓的主要竞争对手。除了在军事雷达中的深度渗透，碳化硅基氮化镓也一直是电信OEM⁷的选择，如华为、诺基亚和三星都在其5G大规模MIMO基础设施中选用了这项技术。碳化硅基氮化镓技术的高带宽和高效率使之在5G市场上不断抢占LDMOS的份额，而且6英寸晶圆平台过渡带给它的益处也开始显现。在此背景下，碳化硅基氮化镓器件市场将以17%的CAGR₂₀₂₀₋₂₀₂₆增长，预期将在2026年达到22亿美元以上。

在Yole专门从事化合物半导体与新兴基板业务的技术与市场分析师Poshun Chiu看来：“然而作为关键的挑战者，硅基氮化镓仍具有竞争力，有望带来具有成本效益和可扩展性的解决方案。尽管硅基氮化镓PA在2021年第二季度其市场体量还很小，但其大带宽和小尺寸的优势吸引了多家智能手机OEM。随着创新型竞争企业的重大技术进步，这项技术可能很快就会在一些低于sub-6GHz 5G手机中被采用。这无疑将标志着硅基氮化镓射频产业的一个里程碑。”

⁷OEM: 原始设备制造商

近世代工厂的加入以及与新兴功率电子硅基氮化镓产业的协同效应也有助于硅基氮化镓射频保持长期发展势头。在手机以及国防和5G电信基础设施应用的推动下，硅基氮化镓器件市场将以86%的CAGR₂₀₂₀₋₂₀₂₆增长，预期将在2026年达到1.73亿美元。

Some players from different backgrounds are engaging in GaN RF

(Source: GaN RF Market: Applications, Players, Technology, and Substrates 2021 report, Yole Développement, 2021)



包括System Plus Consulting和Yole Développement在内的Yole企业集团全年发布大量报告和行业监测资料。此外，专家们还会进行各种重要讲演并组织关键性会议。欢迎访问Micronews，确保不会错过来自业界的最新消息，获知我们的活动概况，包括与领先公司的访谈等更多信息。敬请期待！

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Ezgi Dogmus, PhD. is Team Lead Analyst in Compound Semiconductor & Emerging Substrates activity within the Power & Wireless Division at Yole Développement (Yole). She is managing the expansion of the technical expertise and the market know-how of the company. In addition, Ezgi actively assists and supports the development of dedicated collection of market & technology reports, monitor as well as custom consulting projects. Prior to Yole, Ezgi worked as a process development engineer for GaN-based RF and power solutions at IEMN (Lille, France). Ezgi has authored or co-authored more than twelve papers. After graduating from University of Augsburg (Germany) and Grenoble Institute of Technology (France), Ezgi received her PhD. in Microelectronics at IEMN (France).

Selsabil SEJIL, PhD. is a Technology & Market Analyst, specialized in Compound Semiconductors and Emerging Substrates at Yole Développement (Yole). As part of the Power & Wireless team, Selsabil is contributing to the development of dedicated collection of compound semiconductors market & technology reports and monitor. Previously, she worked as an Integration Engineer for SOI products at SOITEC (Grenoble, France). She also worked in CEA as a process development engineer for 5G applications. Selsabil obtained her PhD. in Material Science from Claude Bernard University (Lyon, France) in collaboration with STMicroelectronics (Tours, France), where her works explored and optimized all the facets of the complete manufacturing of power electronic devices, with a focus on the optimization of SiC epitaxy. During her career, Selsabil SEJIL authored/co-authored more than 8 publications in the semiconductor field. Selsabil was graduated from University Paris Sud with a master's degree in NanoSciences (Orsay, France).

Poshun Chiu is a Technology & Market Analyst specializing in Compound Semiconductor and Emerging Substrates at Yole Développement (Yole). As a member of the Power Electronics & Wireless division at Yole, Poshun focuses on power, RF, and opto-electronics. He is engaged in the development of technology and market reports and is also involved in custom projects. Before joining Yole, Poshun had 9 years' experience in R&D and product management at Epistar (Taiwan & China). He is the author or co-author of more than 10 patents in solid-state-lighting. Poshun was also engaged in the development and evaluation of novel applications of process technology and components based on relevant semiconductor material systems. Poshun received an MSc degree in Microelectronics from National Cheng Kung University (TW) and an MBA from IESEG School of Business (France).

About the report

GaN RF Market: Applications, Players, Technology, and Substrates 2021

The GaN RF market is expected to reach over \$2.4B by 2026 as competition in production of GaN-on-SiC and GaN-on-Si technologies emerges. – Performed by Yole Développement

Companies cited:

Adventech, Aethercomm, Aixtron, Akash Systems, A.L.M.T., Altum RF, Ampleon, Analog Devices, Arralis, AT&T, Baylin Technologies, BAE Systems, Celestia Technologies Group, Cisco, CECS, CETC, China Mobile, China Telecom, China Unicom, CPI, Comtech, Cree, Custom MMIC, Dynax, DragonWave-X, Dowa, Empower RF systems, Enkris Semiconductor, EpiGaN, Ericsson, ESA, Freiburg/Univ.Ulm/Fraunhofer IAF, Filtronic, Freescale, Fujitsu, General Dynamics, Gilat, Global Communication Semiconductors, GlobalFoundries, HebeiKing Ceramic Electronic, HJCW, HiWAFER, Huawei, HUGUES, II-VI Inc, Iconic RF, IMEC, IMECAS, Infineon, Inmarsat, Innoscience, Integra Technologies, Intel, IQE, JAXA, JRC, KDDI, KT, Leonardo, Lockheed Martin, MACOM, Microchip, Microsemi, Mission Microwave, and many more.

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