IQE – The Origin of Most Compound Semiconductor Devices

Most major smartphone launch events are soon followed by "teardown" reports describing how the latest semiconductor IC technologies have been implemented, including which companies won the prized design-ins for RF FEM, 3D sensing, display and power components. Semiconductor companies have created ICs that drive every facet of modern life by connecting us, energizing commerce, enabling education and much more. Many of these IC companies have become household names, but have you ever wondered about the origin of the semiconductor wafers that form the foundation of every electronic and optoelectronic device?

IQE plc is the leading global supplier of advanced compound semiconductor wafers and material solutions. Headquartered in Cardiff, Wales, and operating from manufacturing sites in the U.K., U.S., Taiwan and Singapore, this scale and global footprint allows IQE to ensure security of supply for customers in all parts of the world. IQE's 30-year leadership position is underpinned by a comprehensive product portfolio spanning nearly every major semiconductor material including GaAs, GaN, InP, GaSb, Si, SiGe and others.

IQE's Taunton, Massachusetts facility (IQE-MA) annually produces hundreds of thousands of leading-edge GaAs and GaN epitaxial wafers. Acquired from Kopin in 2013, the 65,000 ft^2 facility was built in 2001. IQE-MA supplies GaAs HBT, BiHEMT and BiFET wafers for 5G FEMs as well as GaAs vertical cavity surface emitting lasers (VCSELs) for 3D sensing, LiDAR and illumination. In 2020, IQE-MA completed an expansion of GaN manufacturing capacity to meet growing demand for 5G infrastructure and defense applications. This increased capacity has also been utilized for GaN-based emitters for high resolution displays including LED/laser development for emerging 5G, automotive, datacom and IoT applications.

The IQE-MA production floor consists of 8,500 ft^2 of Class 1000 cleanroom and is populated by epitaxial growth reactors and metrology equipment. Certain areas associated with wafer handling and QA/QC inspection are provisioned to Class 10. The GaAs and GaN growth reactors use a process known as metalorganic chemical vapor deposition (MOCVD) that produces highly ordered, single crystalline semiconductor materials with precise control of layer thicknesses and alloy compositions. The MOCVD reactors are configured for high throughput with servicing from a maintenance chase while always loading/unloading wafer product from the cleanroom side. IQE-MA is QMS-certified to ISO 9001:2015. Environmental, health and employee safety are top priorities and are certified to ISO 14001:2015.

The IQE-MA facility employs device fabrication and test capability, not for the production of device-level products, but to enable IQE to sample device performance from batches of as-grown wafers before shipping to customers. This capability has proven invaluable for control of production epitaxial processes and helps streamline product development. If IQE can demonstrate, via internal device fabrication and test, the benefits of a change to an epitaxial structure, it can reduce the number of fab cycles required at customer sites. This, in turn, reduces product development schedules and improves time-to-market. Device fabrication steps such as photolithography, wet processing, dielectric deposition and etching take place in a class 1000 cleanroom. Device test (I-V & C-V) and semiconductor materials characterization (such as XRD, AFM, SEM, Hall and photoluminescence) complete the full suite of materials and device capabilities.

A major part of ubiquitous wireless connectivity is enabled by IQE epitaxial wafers. IQE materials are the basis of devices employed for Wi-Fi, RF infrastructure, satcom, automotive, defense, gesture/facial recognition, cloud/networking/IoT, healthcare, industrial and many other applications. Utilizing state-of-the-art facilities such as IQE-MA, IQE has firmly established its position as the world's largest pure-play compound semiconductor epitaxial wafer supplier.

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