

Repair and Maintenance in High-volume MBE Production

W. T. Black

RFMD, 7628 Thorndike Rd., Greensboro, NC 27409, www.rfmd.com, wblack@rfmd.com

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In molecular beam epitaxy (MBE) the most important component of successful material growth is having properly functioning equipment. In high-volume production the MBE reactor must also operate consistently and at the lowest possible cost. This paper discusses the repair and maintenance organization, and the associated infrastructure, necessary to support the equipment requirements of a high-volume MBE production facility.

There are several common factors that are inherent to supporting MBE systems in a high-volume, production environment. The first is a solid understanding of all systems necessary for high-volume production and their individual maintenance requirements. The second is how to deal with the toxic and potentially volatile materials which may be generated in the MBE reactor once it has been vented to atmosphere. The third is handling and disposing of the hazardous waste safely. And finally, pertaining directly to high-volume production is how to consistently perform each process in the shortest amount of time, while returning the highest quality equipment to the production group.

The MBE repair and maintenance organization at RFMD has evolved from a group where every person in some way tried to perform every function, to an organization with four focused areas; MBE equipment maintenance, characterization equipment maintenance, component build, and equipment engineering. The specialization of the individual groups result in a thorough understanding of the individual aspects related to supporting high-volume MBE production. The equipment maintenance group is responsible for disassembly, cleaning and reassembly of the MBE reactor. The characterization equipment maintenance group is responsible for calibration, repair and upgrades of all product characterization equipment. The component build group is responsible for repair and maintenance of all internal system components. The equipment engineering group is responsible for implementing and/or overseeing system repair, troubleshooting, and equipment modifications of all systems used for MBE.

The infrastructure necessary to support the repair and maintenance group has also evolved as our capabilities have matured. We perform approximately 20 maintenance cycles per year resulting in a large number of component repairs and a large volume of consumable parts to order, and the need to track all maintenance related activities. To support these activities we have created dedicated facilities that are appropriately outfitted to efficiently support maintenance operations. For the component repairs, we have a separate room with fabrication, repair, and testing equipment. There is a dedicated wet scrape facility for cleaning contaminated parts, where all hazardous material is contained and collected for reclaim efforts. To support our need for consumables, we have a stock room that is completely supplied with all components necessary for a complete maintenance cycle and other consumables related to general operation. Inventory levels are software controlled to reduce maintenance delays for parts. To allow tracking of maintenance activity times we have database associated software that facilitates the tracking of all activities throughout any system maintenance process.

As a result of the repair and maintenance organization progressing into focused groups with dedicated infrastructure we have achieved increased system uptime, decreased maintenance related downtime, decreased equipment related scraps, and overall improvement in systems and product.