New glovebox designs meet expanding application demands

Whenever new technologies emerge, glovebox designs must evolve

By Christopher M. Bartlett, MBraun Inc., USA

Gloveboxes are designed and engineered to provide an enclosed work space for operation under a controlled environment. Today, gloveboxes serve applications ranging from research and development to the manufacture of medical devices, pharmaceuticals, semiconductors, and batteries, as well as welding and nuclear applications.

To meet the varied requirements of these applications, glovebox manufacturers continually search for and implement new design features both inside and outside the box. These include improved software programming, PLC touch-screen displays, gas purification units, advanced oxygen and moisture sensors, rapid transfer ports, and better feedthrough designs.

Among the benefits of the new designs are improved product quality, better efficiency, greater reliability, more user-friendly interface controls, flexible integrated work spaces, and an effective cost-saving alternative to large, expensive cleanrooms. Instead, gloveboxes work in conjunction with cleanrooms to provide an efficient and productive way to work with sensitive materials.

The new designs also enable end users to more easily add onto existing systems as their research and production needs evolve. Meeting market demands is always the driving factor for new glovebox design, and whenever a new technology emerges so does the design of the glovebox.

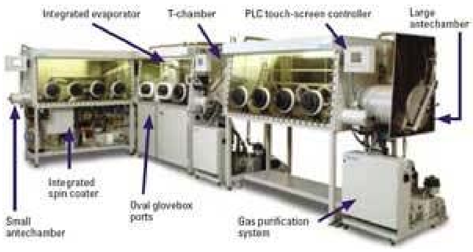
A wide range of applications

Gloveboxes are available in a variety of shapes, sizes, and designs to support different applications, and glovebox engineers have designed and manufactured solutions that fit in limited space as well as improve operating efficiency. For example, larger, more complex gloveboxes are usually integrated into industrial production lines while smaller, more conventional units are used for research and development. The use of gloveboxes is standard in the manufacturing of a number of products, and gloveboxes have been used on laboratory floors for more than 60 years (see Fig. 1).

Click here to enlarge image

Figure 1. *A glovebox used for sample preparation. Photo courtesy of MBraun Inc., USA.*

One major application in particular is thin-film deposition, depositing materials such as calcium, silver, and gold onto wafers or thin-film material under high vacuum. A large number of university laboratories and OEMs have also invested in gloveboxes integrated with thin-film deposition chambers for the research and production of solar cells, crystal displays, and thin-film batteries (see Fig. 2). Glovebox manufacturers frequently build their own deposition equipment for research purposes as well as team up with leaders in the deposition equipment field on joint development efforts.



Click here to enlarge image

Figure 2. *The MB Evaporator glovebox pictured shows three gloveboxes integrated with a square evaporator chamber, a spin coater, Siemens PLC touch-screen controllers, and a t-chamber that connects the gloveboxes together. The design of the MB Evaporator glovebox shows a direct correlation between an emerging technology (alternative energy, OLED display) and a glovebox designed to meet the research and production needs of these technologies. Photo courtesy of MBraun, Inc. USA.*

Another example of two industries working together to provide the best quality system for the application can be found in the welding industry. Weld chambers need an atmosphere free of oxygen and moisture to produce products for medical implants, microelectronics parts, airline parts, and titanium castings. The welding glovebox is integrated with tungsten inert gas (TIG), vacuum, or YAG-laser welding systems. Using weld chambers, manufacturers avoid the need for expensive, manually operated shielding systems such as gas lenses, trailing shields, and backing bars-all of which require highly experienced welders to adjust to the correct shielding conditions. Weld chambers also help prevent discoloration and oxidation in the welding of titanium.

Large, complex gloveboxes are also specifically designed for pilot production systems in the manufacture of high-intensity, metal halide discharge lamps used in homes, automobiles, motorcycles, and many other applications. Lamp-sealing gloveboxes often include integrated cleaning systems for safe and effective removal of silicon oxide dust from the chamber. Plasma jet burners are highly suited for sealing glass tubes within the ultra-clean atmosphere of the glovebox.

Some lamp-sealing glovebox manu-facturers also offer a fully automated pump-fill station that fills the lamp tubes with process gas at a customer-specified pressure and seals them in the inert atmosphere.

Gloveboxes are also standard tools in the research and development of organic solar cells that provide alternative energy solutions. This equipment enables the transfer of extremely clean wafers and provides a process that is exceptional in both efficiency and material quality.

Other gloveboxes are specifically designed for the production of lithium polymer batteries (see Fig. 3). Since lithium is considered a hazardous material under normal atmospheric conditions, the production of these batteries requires careful handling procedures. A great deal of planning and technology goes into the safe storage, shipping, and disposal of the material. In a glovebox, batteries can be produced without the risk of contamination with water and, unlike cleanrooms, the moisture content in a glovebox is uniform, controlled, measured, and independent of the number of operators working in the production room.

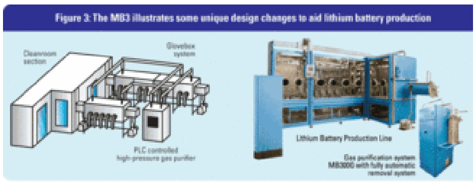


Figure 3: The MB3 illustrates some unique design changes to aid lithium battery production

Click here to enlarge image

Lithium production lines integrated with gloveboxes come standard with high-powered gas purifiers to accommodate the volume of gas that needs to be maintained within the glovebox. Gas purification plays an important role in the ability of a glovebox to maintain a controlled environment, and new gas-purification system designs allow for larger-scale, cleaner, and more efficient ways to reduce the amount of oxygen and moisture contaminants in the atmosphere. Glovebox manufacturers use molecular sieve and copper catalyst to remove oxygen and moisture. Some new designs also integrate solvent dispensing systems into the box as well as solvent vapor traps that remove solvents from the atmosphere and increase the life of the gas purification units. Other features can provide end users with a system that can be regenerated through a touch-screen PLC controller.

Design features like the touch-screen PLC provide the next generation in user-friendly software. The PLC controller can operate basic functions of the glovebox, eliminating the possibility of human error. Gloveboxes designed with the new PLC controllers can also better track operational hours of the box and provide feedback to the end user about potential problems and when they occurred. Troubleshooting errors in the glovebox through the PLC controller can save users time and money in their research and production.

Glovebox manufacturers have also redesigned and upgraded analyzers to monitor oxygen and moisture levels within the glovebox atmosphere. The analyzers-which are calibrated using NIST traceable gases-provide real-time measurements on a PLC controller to offer an easy, accurate, and reliable reading.

Gloveboxes as isolators

The pharmaceutical glovebox (isolator) is another example of a system specifically designed to meet the unique needs of a particular application. The pharmaceutical industry uses isolators for the packaging of medicine, sterility testing, potent compounds testing, liquid filling, sterile processing, and powder processing. The barrier isolators used in the pharmaceutical industry are designed to provide the barriers of protection needed in the handling of hazardous chemicals, microbiological agents, and/or radioactive material often found in pharmaceutical compounds, chemotherapy agents, and IV admixtures. A large number of pharmaceutical isolators incorporate laminar air flow technology in their design. This feature provides directed air flow for applications requiring low particle counts in addition to user protection.

Barrier isolators are also designed for many other applications crossing various marketplaces. For example, smaller, more compact stainless-steel gloveboxes are commonly found in mobile laboratories that respond and work in the detection and cleanup of possible bioterrorist threats. Other glovebox designs, like acrylic, single-molded systems, can provide users with added protection over fume hoods when working with sensitive material.

Conclusion

Technological breakthroughs and customer requirements will continue to change and improve the designs and capabilities of gloveboxes, but one primary function will stay the same-the ability to maintain a controlled environment. As technology advances, so will the capabilities of the glovebox.

Christopher M. Bartlett is marketing coordinator at MBraun Inc., USA.

CleanRooms July, 2007
Author(s) : Christopher M. Bartlett

Links referenced within this article

Find this article at:
http://cr.pennnet.com/display_article/298336/15/ARTCL/none/none/New-glovebox-designs-meet-expanding-application-demands/?pc=ENL

☑ Uncheck the box to remove the list of links referenced in the article.