CHAPTER 18

OTHER BRAZING PROCESSES

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Photograph courtesy of Nuvonyx, Incorporated
Any source of heat that can raise the temperature of components to be joined to a suitable temperature can potentially be used to produce a brazed joint. However, numerous factors—including cost, production rate, and the quality of the braze—influence the selection process. As a result, several processes have become dominant in the manufacture of brazed joints. The most common commercially employed brazing processes have been covered in previous chapters.

Nonetheless, several other processes have found use in commercial practice. These are not used extensively and, in fact, a few are considered obsolete. They are used primarily for niche applications either (1) because they satisfy a unique need for a specific type of heating or (2) due to the availability of equipment and the expertise of the organization.

Electron beam braze welding (EBBW), exothermic braze welding (EXBW), and infrared brazing (IRB) have found use on a limited basis. Laser beam braze welding (LBBW) is an emerging process finding increasing application. Block brazing (BB), flow brazing (FLB), and twin carbon arc brazing (TCAB) are little used and are no longer considered efficient processes. Microwave brazing is an emerging process that is being developed. This chapter presents brief overviews of these processes.

**ELECTRON BEAM BRAZE WELDING**

Electron beam braze welding (EBBW) is a highly specialized brazing procedure that is useful in limited applications. The components to be joined are heated locally to a suitable brazing temperature by defocusing a beam of electrons. This process is always performed in an evacuated chamber in high vacuum [i.e., $10^{-4}$ torr to $10^{-5}$ torr (0.1 micron to 0.01 micron)] and is very similar to electron beam welding (EBW). For brazing, the electron beam is defocused onto a relatively large beam spot to avoid melting the base metal.

Electron beam braze welding has many advantages. Many of these relate to the brazing being performed in vacuum. Flux is not needed to assure the flow of the brazing filler metal. This eliminates the need for postbrazing cleaning as well as any concerns associated with flux entrapment. Refractory metals and other metals that are sensitive to oxygen, difficult-to-wet, or for which no effective commercial fluxes are available can be joined by EBBW. Joints are kept free from oxidation, and because the heating is very localized, distortion is kept to a minimum. This localized heating also allows thin components to be joined as well as components of dissimilar thickness or mass. The process cycle is fast, with heating times of 2 minutes (min) to 4 min possible. The process is highly repeatable.

Electron beam braze welding has its limitations. The size of components that can be joined is limited by the size of the vacuum chamber. Specialized skills are required to operate the equipment. Due to the localized heating and the assembly's being located in a closed chamber, close control of joint clearance and quality are essential. Total cycle time is dependent on the level of vacuum required as the chamber needs to be pumped down prior to brazing. Materials with high-vapor-pressure elements such as zinc cannot be joined as they volatilize in vacuum during the process.