Joining is an important step in manufacturing of aerospace thermoplastic composite structures. In general, joining of thermoplastic composites can be categorized into mechanical fastening, adhesive bonding, and fusion bonding or welding. Fusion bonding or welding has great potential for joining, assembly, and repair of thermoplastic composite components and offers many advantages over other joining techniques. This presentation addresses critical technical aspects of the fusion bonding process such as, heat generation at the weld interface, process modeling, process methodology, process parameters, mechanical performance, and automation. At the end, it presents the areas of improvement for further development and advancement in this field.