CHAPTER 20

ALUMINUM AND ALUMINUM ALLOYS

Prepared by:
J. Schuster  
Omni Technologies Corporation
R. McKinney  
Prince & Izant
S. Urban  
Fusion, Incorporated

Contents
Introduction 370
Materials 370
Material Preparation 373
Joint Types 373
Performance of Joints 375
Corrosion Resistance 376
Applicable Brazing Processes 376
Dissimilar Metal Brazing 378
Postbraze Cleaning 378
Bibliography 379
Suggested Reading List 379
Aluminum and aluminum alloys are brazed using practices similar to those used for brazing other metals except that different fluxes, different brazing filler metals, and generally lower brazing temperatures are used. The brazing of aluminum and aluminum alloys is performed in two modes—with flux and without flux.

Aluminum and its alloys can be brazed using most standard brazing processes. These include the torch, dip, and furnace processes. Furnace brazing can be carried out in air or a controlled atmosphere, including vacuum. Other processes, including induction, radiant lamp, and resistance brazing may be used for specific applications. Regardless of the method used, close control of the process parameters is required for successful brazing.

**MATERIALS**

Aluminum brazing generally involves one aluminum alloy component being joined to a second different aluminum alloy component with a third aluminum alloy as the brazing filler metal. This produces an all-aluminum structure that can be heat treated and finished using standard practices such as anodizing and conversion coating. The second alloy may be the same as the first, a different alloy, or a dissimilar metal, such as steel or nickel. Flux may be used as a consumable.

**BASE METALS**

The aluminum alloys that can be brazed are listed in Table 20.1. These include a number of nonheat-treatable and heat-treatable wrought alloys and casting alloys. The nonheat-treatable alloys include the high-purity aluminums and those with low additions of alloying elements. The mechanical properties of these alloys can be increased by cold working, but softening by recrystallization will occur due to the heat of brazing. Aluminum Alloy 3003, the most commonly brazed alloy, is included in this group.

The heat-treatable alloys, which generally contain magnesium and silicon, are classified as the magnesium-silicon types and make up the 6000 Series of aluminum alloys. These alloys begin to melt at lower temperatures than those in the 3000 Series because of their higher total alloy content. Consequently, they are generally brazed at lower temperatures than the nonheat-treatable alloys.

The heat-treatable alloys, including the commonly used 6061 alloy, are thermally treated during post-braze fabrication or during the brazing cycle to obtain high mechanical properties. The cast aluminum alloys, which are most easily brazed, are generally low in silicon and magnesium content, which may limit their brazability.

Not all aluminum alloys can be brazed. The high-strength, high-magnesium 5000 Series wrought aluminum alloys such as 5052 and certain casting alloys contain high amounts of alloying ingredients. These alloying ingredients often prevent the brazing filler metal from adequately wetting. These alloys also melt at temperatures below those of commercially available brazing filler metals.

---

1. For further information on the aluminum series designation system, see the Aluminum Association, www.aluminum.org.
2. Refer to Chapter 3 for a listing of brazing filler metals used in the brazing of aluminum.