CHAPTER 29

PRECIOUS METALS

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INTRODUCTION

Pure and alloyed precious metals are desirable for electrical and electronic contacts in industrial applications because they offer good electrical and thermal conductivity, resistance to corrosion, and suitable behavior under arcing conditions. In dental applications, precious metals offer resistance to corrosion, strength, biocompatibility, workability, and in some cases, aesthetics. The jewelry industry uses precious metals as an art medium of high intrinsic value primarily because of aesthetics. Corrosion resistance, however, is another consideration.

Brazing is the most common method of joining precious metals to precious metals and to other base metals. Brazing, which utilizes the flow of the brazing filler metal between the fitted joint surfaces, is ideal for the production of joints between electrical contacts and the support conductors. Such brazements provide good thermal and electrical conductivity plus adaptability for the joining of many combinations of contacts and base metals. The production brazing of electrical contacts is a highly specialized field in which the quantity produced greatly influences the selection of brazing techniques. Examples of finished electrical contact parts are shown in Figure 29.1.

Although it is usually referred to as soldering when employed in the jewelry or dental fields, brazing can provide invisible joints free from surface imperfections in which foreign materials can become lodged.

GOLD AND GOLD ALLOYS

Commonly used karat gold alloys contain additions of copper, silver, zinc, and sometimes nickel or palladium. Copper, silver and zinc provide strength and balanced color to yellow karat gold alloys. Nickel, copper, and zinc are added to yield a white gold alloy, and if ductility is critical, the nickel is replaced with palladium.

U.S. hallmarking laws allow jewelry “solders” to contain less gold than the noted karat so that these brazing alloys can melt at lower temperatures. Dental alloys are chemically similar to jewelry alloys, although they always contain platinum or palladium to obtain the greater corrosion resistance required for oral restorations. Dental alloys used for aesthetic restorations (with porcelain) are usually gold and/or palladium alloys with high melting temperatures.

Gold alloys are commonly brazed at the dental technician’s or jeweler’s bench with a torch, since these articles are often one-of-a-kind items. Mass production of jewelry earrings and chains is accomplished by means of belt furnace brazing of stamped or woven components that have a brazing alloy as an integral part of the karat gold.

Pure gold is the preferred electrical connector material for low-voltage applications because of its freedom from corrosion, thus ensuring a steady stream of electronic data. Pure gold is electroplated onto copper-alloy spring materials and is used for computer and telephone connectors. These connector materials are frequently soldered onto circuit boards or wire harnesses.

PLATINUM GROUP METALS

Well known for their corrosion resistance, the platinum group metals and alloys have numerous industrial and jewelry uses. Platinum is the most commonly used metal for catalysts. It is sometimes combined with thorium oxide to increase its high-temperature life. Palladium alloyed with silver is frequently used in electronics applications. Palladium is also heavily favored for automotive catalytic converters.