The assumption should be made that specimen problems do exist unless proven otherwise. The absence of preparation data (or the presence of very cursory data) implies either inattention or blatant disregard for this factor. Obviously, neither attitude is conducive to good samples, and such investigations should be viewed with reservation.

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Utilization of Phase Diagrams

Phase diagrams are justifiably regarded as an important component of our technological society; the *Bulletin* will publish examples that illustrate their value in the development of new science, trouble shooting, manufacturing control, and the development of new materials. Readers are invited to share their experiences by submitting items to the Editor, in any area of application.

Phase Diagrams in Dental Metallurgy

All metals used in dentistry must have exceptional corrosion resistance and high strength. They may be classified according to use into: (*a*) metals used for direct restorations; (*b*) metals used for casting indirect restorations; and (*c*) wrought metal wires and appliances used in orthodontics and oral surgery.

Gold foil and silver amalgam are compacted directly into a cavity for restoration. Silver-amalgam alloy consists of Ag_3Sn, to which has been added copper and sometimes other alloying elements. Particles of this material are agitated with mercury and react with it to form a plastic mass that hardens rapidly. The phase relationships in the quaternary Ag-Sn-Cu-Hg system involved in this hardening reaction are not yet fully understood. The phases found in dental amalgam are, however, identifiable as phases found in the corresponding binary and ternary systems.

Many of the casting alloys are gold-base, and they are commonly used in the as-cast condition. Platinum, palladium, and silver are used for solid solution strengthening; iridium and ruthenium, which are nearly insoluble in gold, are used for grain refinement. Sometimes alloys containing 5% or more of copper are age-hardened by precipitation of Au_3Cu. In recent years, the high cost of gold has led to the use of alloys at both ends of the silver-palladium system. These two metals exhibit complete miscibility in the solid state.

Cobalt-chromium–base alloys have been used for casting for several decades, though the cobalt-chromium phase diagram still has not been fully established. Recently, nickel-chromium alloys have come into wider use. For this system the equilibrium structure for the range of chromium contents normally used is a solid solution of chromium in nickel.

The wrought wires used in orthodontics are of austenitic stainless steel, nitinol (TiNi), and ELGILOY® alloy.* Phase relationships in these systems are well established. In oral surgery, austenitic stainless steel and alloys in the nickel-chromium and cobalt-chromium systems are used predominately.

Overall, it is clear that the evolution of dental alloys has tended to be empirical. In some instances their metallurgy is understood in terms of phase diagrams, but, in others, e.g., ternary and higher-order alloys based on the cobalt-chromium system, basic information needed for such understanding (such as the avoidance of sigma and other embrittling phases) is still missing.

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Contributed by **A.A. Johnson** and **J.A. Von Fraunhofer,** University of Louisville, Louisville, KY 40292.