

Low fused alloys as an educational and industrial aid Practices in casting and electrodeposition forming

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Abstract

A low-fusing alloy is an alloy containing mainly lead, tin, and bismuth which melts in the temperature range 47°–170°C (117°–338°F) used for making casts and dies. Lead, tin, and low melting alloys are non-ferrous alloys that are easily meltable with relatively low melting temperatures. They are used in the manufacture of solders, semiconductors, batteries, optical, and decorative products. Low melting alloys may include antimony and cadmium but the most common constituents are bismuth, indium, lead, and tin metals and alloys. Bismuth is a low melting point metal used as a substitute for lead in solders. Bismuth tellurides are excellent thermoelectric materials and are finding use in coolers. Indium is used to form several low melting alloys and solders. Indium based solders can "cold weld" because indium tends to be more oxide free, so heat and chemicals are not typically required compared to conventional solders. Indium based solder also reduces gold scavenging - extraction of gold from metal electronic contacts. Lead is a metal with a low melting point, a high density, and low hardness. Lead and lead alloys are used in balancing weights, radiation shielding, battery electrodes, and solders. Tin is a silvery, malleable metal with a low melting point and low hardness. Tin and tin alloys are used in coatings and platings, as alloying additives, in battery electrodes, and as solders. (alvin 1998). The Selection of metal alloys requires an analysis of the desired specifications. Dimensions to consider include outer diameter (OD), inner diameter (ID), overall length, and overall thickness. Other specifications of importance (based on application) include product shape, tensile strength, yield strength, melting point, conductivity, corrosion resistance, ductility, and malleability. These properties differ based on the material or alloy composition. Low melting metal alloys are used as a constituent in fusible alloys for use in fuses, thermostats, switches, barometers, thermal management products, tube bending, lens blocking, potting molds, wax pattern dies and punch anchoring, fire suppression water sprinklers, and workpiece holding (globalspec 2012). **Statement of problem:** Low fusing alloy has been used in a number of industries and in many other civilian practices. In dentistry this type of alloys has been used for remount procedures in both fixed and removable prosthodontics, and even in implant prosthodontics for the fabrication of solid implant casts. Other uses include modeling for a number of purposes. Those alloys are never tested for usability in teaching design classes. It is expected that the modeling using low fused alloys is step forward in the direction of getting students acquainted with metal products design.

Objective: This article reviews the physical properties, metallurgical considerations of low fusing alloy, its applications in design practice for, teaching casting, electrodeposition forming, and many other, safe, and simple method of using low fusing alloy in teaching in design classes.

Major Results: Low fusing alloys have proved to be a great aid to the design modeling processes. A comparison was carried out between different formulas that could serve the paper objectives. The best specification has been decided on basis of experimental work and review of the literature. Curves are shown to illustrate behaviour of certain low fused alloys. The mechanical properties of a selected sample of alloys showed a considerable convenience for the purpose of the study. The use of specific alloys allowed the authors to build and form valuable models from the point of view of students and referees. Despite being harmful sometimes, they

can be used by students provide cautions are taken to facilitate for a safer use. Alloys of this type proved to be valid for teaching courses such as casting technology for being safe, fast and compliant.

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