Creating medals using low-melting elemental metals and alloys, graphite molds, and materials affordable to those who teach

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Introduction

Creating art medals in a chemistry laboratory may not at first seem to be a common venue or project for either artists or chemists. Yet there are several connections that bring art and science together in such a teaching environment. Both studios and labs often have the ability to heat materials; and in our lab we can heat metals such as tin or lead, and alloys such as Wood's metal and Onion's metal. The latter two melt in boiling water, which makes them extremely easy alloys with which to work, although they can be melted on a hot plate directly, if desired. In addition, we utilize graphite blocks for mould material, because graphite has a high specific heat. This means it can absorb the heat from molten metal very quickly and very well, making the cooling process quite rapid. Also, and very importantly, graphite is relatively easy to carve.

Our process is a straightforward one. First, sketch on paper the basic idea to be converted into a medal, carve it into a graphite block in the negative, dam the edges of the graphite mould to keep molten metal from pouring over the edges, then gravity pour the metal of one's choice into the mould. Some time must pass to allow the metal and mould to cool – usually only minutes – and the medal can be removed from the mould. From this point, no further treatment of the finished medal is required. Tin routinely solidifies with a mirror finish, while the low-melting alloys form solid surfaces with a crystalline look to the surface.

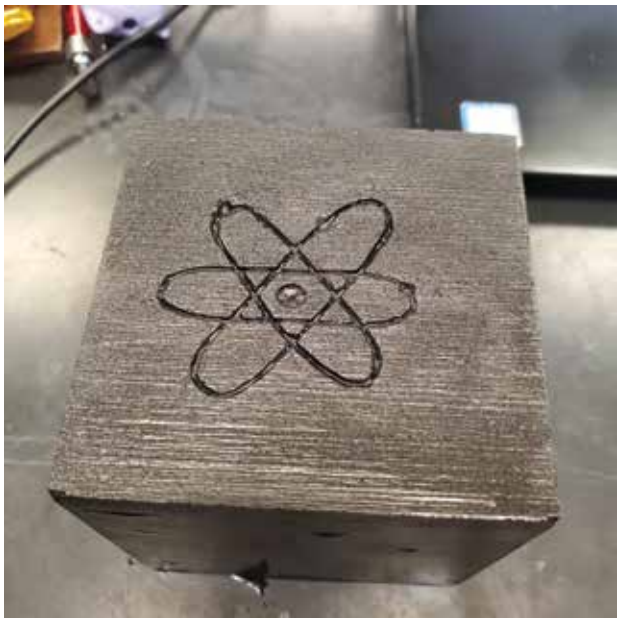

Fig 1.

Production and creation of medals

The creation of a medal using this technique can be broken down into a few basic steps, which we describe here.

Producing the design

As with all art medals, the first step in the production of any medal through this technique is some form of sketch or drawing. Since we are working with students who have just come to a college, we expect some of their designs to be relatively simple (although some are wonderfully artistic). We encourage them to expand on their image, and in some cases to determine how the image that has been drawn can be simplified.

Carving the design in graphite

Arguably the longest most labour-intensive step in our process is carving the design in graphite, as seen in the first and second photos (figs. 1 and 2). While graphite carves easily with woodcarving tools, or any other iron stylus-type tool, it is somewhat more difficult to etch than wet or moistened clay. To make the process considerably quicker, we often employ hand-held drills or a drill press and router bit as the major tools to carve the graphite mould. Both of these can move significant amounts of graphite with little effort on the part of the person carving, and can do so in a relatively short amount of time. A drill press mounted with a router bit is especially useful in carving out an even field in the graphite block, a field from which raised design elements can then be formed. As a safety precaution, we take care in this step because it can produce a significant amount of graphite dust, and because a drill press moves any drill bit very swiftly. Wet paper towels around the drill press keep the dust down,

Fig 2.

Fig 3.

and wearing a work mask keeps the artist from breathing it. As well, safety glasses are essential in keeping excess dust out of the eyes.

We remain interested as to the amount of time needed to carve a mould, since we work with students in a teaching laboratory-studio. Our normal time for such laboratory classes is three hours, but we recognize that some teachers have less than this per class period. Perhaps obviously, the carving of any medal can be done over more than one class session. But it is very satisfying to see a design take shape in a single class. An example of a carved mould can be seen in the figure.

Masking off the edges of the mould

After a design is carved, the edges of the mould need to be masked off in some way, to ensure that molten metal does not spill outside of the newly established mould. We have found that something as simple as masking tape works well in this regard. Simply tape along the edge of the mould, with half of the width of the tape directly stuck to the graphite block, and half above the block, acting as a dam to the flow of the molten metal. The third figure is a photo of this (fig. 3). The temperature of molten tin, or of Wood's metal or Onion's metal, is not high enough to burn or scorch the masking tape.

Pouring the metal

Pouring molten tin, or one of the low-melting alloys such as Wood's metal fusible alloy, is often the highlight of the medal production process for our students. Tin, Wood's metal fusible alloy, and other metals can all be melted on a standard hotplate using a wide variety of containers. Something as simple as a frying pan works well, as do porcelain crucibles, as seen in the figure, the fourth photo (fig. 4).

There is something of an acquired skill to pouring metal at the correct speed. Too quickly and the metal may run over the sides of the mould or splash, even if it is dammed. Too slowly and the metal may solidify before reaching the edges of the design. We encourage students to pour multiple times if they need to, melting any trial that was not satisfactory to them.

Allowing the medal to cool

We have mentioned that time becomes an important factor when creating art medals in a classroom or teaching laboratory setting. One reason that graphite is such an excellent medium for casting medals is that it has a very high specific heat, which means it removes the heat of the molten metal from the medal quickly. The graphite block does heat up, but the molten tin or low-melting alloy solidifies in a matter of minutes, and while using leather

Fig 4.

gloves, can be removed from the mould in a very short time. Plunging the finished medal into cold water for no more than one minute makes it easy and safe to handle, as also seen in the second photo (fig. 2).

Perhaps obviously, removing the medal from its mould is the ultimate step, in that this is the moment at which the artist can first see their medal. Artists often put considerable energy into some steps taken after a medal is removed from a mould to impart a special finish or patina to their finished work. We report that when tin or low-melting alloys and graphite moulds are used, the medal needs no further work at all if a highly reflective shine is the desired finish.

Thoughts for the future

We believe this technique for creating art medals – the use of graphite moulds, drill presses, hand drills, and hand tools – is one that can be adapted to virtually any studio or art classroom. We have found that students who have never carved a medal before can achieve good results in making a mould in three hours or less. We have also found that tin, Wood's metal fusible alloy, or Onion's metal are all excellent metals for casting medals. Additionally, we have found that students can learn a great deal about the medal making process by pouring their medal as many times as they desire, until they achieve the result they want.