

METALLOGRAPHIC SPECIMEN PREPARATION PROCEDURE FOR THE C26000 ALLOY

This section summarizes the procedure for preparing a specimen of C26000 brass for metallographic observation. It is divided into the major steps of specimen preparation, each describing the general procedure and its objective and also the specific procedure for the C26000 alloy.

Sectioning

General: The objective is to obtain a specimen of manageable size. One might use a manual saw, abrasive cutter or a precision diamond saw.

Rough Grinding

General: The objective is to remove surface deposits and burrs and to produce at least one reasonably flat surface. Belt or disk grinders are often used.

Mounting

General: The primary objective is to provide a safe and convenient means for handling the specimen. Another common objective is to help to prevent rounding of edges of the specimen during grinding and polishing. Often the size and shape of the mounted specimen is such that it can be loaded into the chucks which are used in automatic specimen preparation systems. Methods of mounting the specimen may include cold mounting using epoxy/resin mixtures or hot compression mounting using wax preforms or powders.

Specific: Mount the specimen in either Buehler's Transoptic powder or phenolic premolds using the Buehler Simplimet press. Use the standard mounting time, pressure and temperature. Make sure the specimen stays in the center of the die when loading the mounting compound.

Fine Grinding

General: The objective is to produce a specimen whose surface roughness is just right for the final polishing stages. To do this the specimen is systematically abraded using an increasingly finer grit grinding papers, taking care to prevent heating the specimen or introducing additional distortion in its structure. By this process the surface scratches and the cold worked layer of material just under to the surface become progressively smaller. Grinding papers or rotating grinding wheels which use either SiC-based abrasives, alumina abrasives or, if the specimen is particularly hard, coarse diamond powders may be used. Water may be used to keep the specimen cool and to remove debris.

Specific: Perform planar grinding using a succession of 240, 320, 400 and 600 grit SiC papers with water as a coolant. Both the Handimet grinders and the polishing wheels equipped with grinding papers can be used. Make sure that you do not bevel the specimen. After grinding the surface of the specimen should be flat and free of all scratches except those produced during the last stage of grinding.

Rough and Fine Polishing

General: The objective is to remove all remaining scratches and produce the smooth, flat surface required for microscopic examination. Typical polishing methods utilize polishing cloths impregnated with a fine powder made of hard materials such as alumina, silica, chromium oxide, magnesium oxide or diamond. Crystallite sizes typically range from 9 to 0.05 microns. Water may be used to keep the specimen cool and remove debris. The final stages of polishing might be done using a combination of mechanical polishing and chemical attack. In attack polishing the rate of removal of material by mechanical and chemical means is balanced.

Specific: Rough polishing is not necessary. Start with intermediate polishing using 6 micron diamond and an appropriate extender on a napless nylon cloth. Next, fine polish using 0.05 micron alumina and water on a felt cloth such as Buehler's Microcloth. For the final polishing stage two methods are available: 1. Attack polish using 0.05 micron alumina and 10% FeN, 2. Polish on the Vibromet using Microcloth and Buehler's Mastermet (0.05 micron silica in a high-pH solution). The final result should be a clean, shiny and flat specimen that has no visible pits or scratches when viewed with the unaided eye and but a few fine (ideally none) scratches when viewed under the microscope.

Etching

General: The objective is to reveal the fine details of the specimen's microstructure by chemically removing material associated with selected features, staining them and even anodizing the surface of the specimen. Etching might utilize only a chemical etchant or a combination of chemical etchant and an electric potential, ultrasonic agitation, magnetic fields, etc.

Specific: Etch for 5 to 10 seconds by immersing the specimen, face up, in a solution of 25 g FeCl₃, 20 ml HCl, 100 ml H₂O. Remove the specimen from the etchant as soon as its finish is dulled and without wasting any time rinse off the etchant by swirling the specimen in a beaker of clean water. Finally, rinse the specimen with alcohol to displace the water then gently air dry it. If the specimen was under-etched simply repeat the etching procedure, allowing the finish to be dulled a bit more. Be careful to not over-etch the specimen. If this happens the final stages of polishing will have to be repeated before the specimen can be etched again.