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Improved Adhesions for Petrographic Thin Sections

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Abstract

A technique is described which permits essentially bubble-free mixing of epoxy resin and hardener in sealed weak-walled polyethylene plastic bags. Bubble-free resins facilitate the making of improved petrographic thin sections. Advantages of sealed-bag mixing over conventional open-vessel mixing include elimination of glassware, reduction of human contact with resins and their fumes, and ease of handling and disposal of unused resin.

Eukitt, a commercially available cover slip mounting medium, is also described. Though not as strong as epoxy, Eukitt requires no mixing or curing, and cover slips are either permanently bonded to the slides or can be easily removed by soaking them in xylene. Cover slips are immobilized on the slide in a few minutes. Eukitt can also be used to quickly make permanent mounts of mineral grains or other small particles. When completely dried, Eukitt has a refractive index of approximately 1.533.

Introduction

Epoxy and similar resins used to bond rock slabs to microscope slides preparatory to making thin sections have the essential properties of great strength, optical clarity and, when unstrained, optical isotropism. Unfortunately, they require that a hardener be added to and thoroughly mixed with them immediately before use. Mixing is commonly performed with a glass stirring rod in a glass vessel. Cleanup requires dissolution with alcohol of the resin adhering to the vessel or, in the case of water-soluble resins, washing with soapy water. Disposable mixing vessels made of cardboard or plastic are also used which require no cleanup except for the stirring rod.

There are, however, many disadvantages to this method of open vessel mixing. Moisture from the air can enter the resin and impair polymerization; solid particles from the air, vessel, or stirring rod can also enter and cause difficulties; and irritating fumes are released from the open vessel which is commonly held close to the mouth and nose of the worker as the resin is being mixed. Also, air is intimately mixed with the resin, forming a myriad of minute bubbles which can be troublesome as thin sections are prepared. Bubbles not only interfere with observation of microscopic detail of the section, but, during final grinding, the thin rock section beneath a bubble is unsupported and may disintegrate. Removal of bubbles from the resin in a vacuum chamber is a slow, usually incomplete process requiring a fairly strong house vacuum or a separate vacuum pump and chamber. It also causes the release of fumes, and the froth formed may contaminate the outer surface of the mixing vessel. In addition, the resin is difficult to withdraw from the vessel, it is difficult to apply with the stirring rod or pour from the vessel; it tends to contaminate the work area, may induce dermatitis, is hard to remove from surfaces or the hands, and much of it tends to remain in the mixing vessel or on the stirring rod to make the task of cleanup all the more difficult. Unused resin must also be disposed of, and alcohol-resin solutions will eventually clog sink drains.

Mixing Bag Technique

To obviate or greatly diminish these shortcomings, an alternate technique employs 5–10 μm (2–4 mil) thick weak-walled polyethylene bags as mixing vessels. Bags of various sizes are commercially available or can be made from polyethylene tubing using a thermal sealer (see Cole-Parmer plastic ware catalogs). However, an adequate supply of mixing bags can be easily made from a sheet of polyethylene plastic. The sheet is folded over on a plate glass surface, a steel ruler is positioned so that one edge delineates the side seam, and the ruler rests on that portion of the plastic which will eventually become the mixing bag. A curved metal rod (Fig. 1), gently heated in a flame, is placed against the ruler's edge and drawn across the plastic. With practice, hermetic

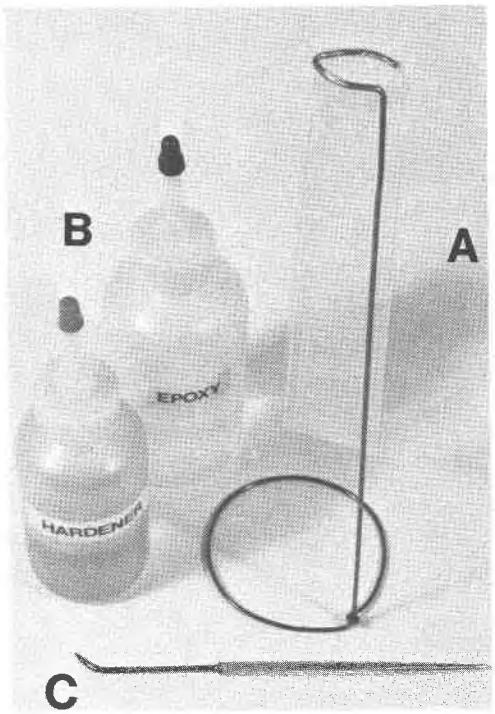

Fig. 1. Wire ring stand supporting weak-walled polyethylene mixing bag (A). Mouth of bag held open by upper wire ring to accept proper amounts of epoxy and hardener in squeeze bottles (B). Curved end of instrument (C) used to thermally seal seams of mixing bag. Instrument is 25 cm long.

seals are easily formed. A second seam, at right angles to the first, forms the end seam. If still attached to the sheet, the bag is excised with a razor cut along the fused seam. For mixing purposes, long narrow bags are best (Fig. 1). If approximately 15 ml of mixed resin is required for a particular purpose a bag 20 cm long and 3.2 cm wide (flat width) is used. The bag is mounted open end up in a specially constructed wire ring stand (Fig. 1), and the proper amount of resin is added either by filling the bag to a premeasured level; by weight, with the ring stand mounted on the weighing pan of a scale; or by adding the appropriate number of drops of resin, followed by addition of the hardener. Dispensing resin and hardener is greatly facilitated by storing the liquids in capped nozzle-tipped polyethylene squeeze bottles (Fig. 1).

Nearly all air is excluded from the bag by gently squeezing it against a table top. The top of the bag is double-folded and closed with a paper clamp. Mixing is performed with the fingers until the liquid is optically homogeneous, occasionally translating the entire contents of the bag from one end to the other by squeezing the bag against a table top (Fig. 2). Mixing is at least as complete and as quickly performed as conventional stirring with a rod in an open vessel. The bag should be no more than one-third full and care should be taken not to burst the wall or seam or extrude resin by exerting excessive force during mixing.

Any bubbles included in the resin prior to sealing the bag tend to be few and remain large and therefore easily removed or avoided during use. A small pinhole transforms the mixing vessel into a dispenser allowing the proper amounts of resin to be discreetly deposited where needed by simply squeezing the bag. Nearly all the resin can be extruded, thereby eliminating waste, and any unused portion is allowed to polymerize in the bag before discarding. There is no cleanup, no glassware, and the paper clamp is reusable. The mixing bags are inexpensive and larger or smaller amounts of resin can be mixed by varying the width or length of the bag used. In addition, contact with the resin and its fumes is minimized, although filling the bag and dispensing its contents should be done under the hood. The advantages of this mixing method over open-vessel mixing make it preferable even if the resin is to be used for purposes other than preparing petrographic thin sections, such as experimental run mounts.

Mounting Cover Slips with Eukitt

Epoxy resins are particularly useful, because of their great strength, in the initial adhesion step of preparing petrographic thin sections when the rock slab is bonded to the glass microscope slide and then thinned on the cut-off saw. Adhesion of the cover slip, however, does not require a particularly strong bond and a substitute for epoxy, called Eukitt, may be used instead. It is distributed by Calibrated Instruments, Inc., 731 Saw Mill River Road, Ardsley, New York 10502. When dried, Eukitt is nearly as strong as epoxy and is probably as long lasting on the slide since it does not discolor or become brittle with age. In addition, it is isotropic, colorless, clear, bubble-free; it requires no mixing, curing, clamping, or oven heating; and slides may be studied (with care) a few

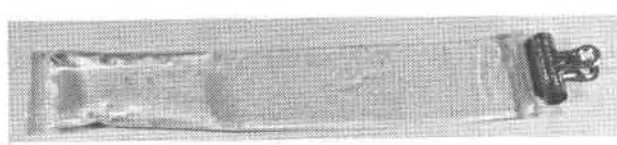

FIG. 2. Mixing bag sealed at one end with clamp. Most of the epoxy-hardener mix is at one end. A pinhole at one corner of the bag permits controlled dispensing of mixed epoxy. Bag is 20 cm long.

minutes after the cover slip has been positioned. Also, a large number of slides can be prepared from a small amount of Eukitt, and if it becomes too viscous, because of solvent evaporation, it can be diluted with xylene. To ensure bubble-free application of the cover slip, the only required precaution is to moisten the entire surface of the section with a few drops of xylene before placing Eukitt on it, or to use a thin solution of Eukitt. After a few hours of drying, the cover slip is permanently attached but can be easily removed by soaking the slide in xylene (1) if the slide is too thick and must be reground, (2) if chemical analysis is to be made on the section, or (3) if the cover slip must be replaced if accidentally broken. Neither xylene or Eukitt appear to have a deleterious effect on the cured epoxy beneath the rock section.

When dry, Eukitt has a refractive index of approximately 1.533; when wet, somewhat less. Becke line effects at the edge of the section, however, are determined by the refractive index of the epoxy used to bond the rock slab to the glass slide since it is usually this material which surrounds the thin section, unless the edges of the section are scraped to remove the epoxy which is often contaminated with grit and dirt (Rudolf von Huene, personal communication). Eukitt can also be used to quickly prepare whole grain mounts of minerals or other small particles.