Removal of Double-Stick Carbon Tape from Scanning Electron Microscope Specimen Holders

William F. Chissoe, University of Oklahoma and Samuel Roberts Noble Microscopy Laboratory, Norman, OK 73109

Edward L. Vezey, Oklahoma State University–Oklahoma City, Oklahoma City, OK 73107

John J. Skvarla, Department of Botany-Microbiology and Oklahoma Biological Survey, The University of Oklahoma, Norman, OK 73019

Double-stick carbon tape is frequently used in scanning electron microscopy to attach specimens to specimen holders. An excellent adhesive, double-stick carbon tape has the added advantage of being electrically conductive. However, recycling specimen holders has been problematic because carbon tape adheres tightly to the holder, making removal difficult. Labs using carbon tape have attempted to solve this problem in a variety of ways. We obtained excellent results by first removing the tape with the chisel-shaped end of a wooden dowel, then treating holders with a metal polish and a brief sonication in Formula 409, and finishing with rinses in water and methanol.

INTRODUCTION

Specimens observed with a scanning electron microscope (SEM) must be securely fastened to specimen holders with some type of adhesive. Otherwise, conditions such as vacuum and beam/specimen interactions are likely to cause specimen movement that disrupts viewing and photography. Common adhesives include paints, glues, tapes, rubber cement, and double-stick carbon tape (Whitcomb 1981, Murphy 1982, Chissoe et al 1994). Because specimens in a conventional SEM must be electrically grounded, carbon tape has the advantage of providing both excellent adhesion and conductivity (Whitcomb 1981).

For the last 8 y, we have used 8 mm double-stick carbon tape (Ted Pella, Inc., Redding, California) in our taxonomic and floristic pollen surveys, commonly employing up to several dozen specimen holders in a single investigation (e.g., Ickert-Bond et al. 2003). To conserve resources, we routinely recycle specimen holders for use in other SEM investigations. However, removal of carbon tape is a deceptively difficult challenge. The major problem is that gummy components of the carbon tape do not respond satisfactorily to standard techniques of cleaning with alcohol and ketone solvents (Whitcomb 1981, Murphy 1982). As a result, sticky residues remain on specimen holders, often making them unsuitable for further use. As the cost of SEM supplies continues to rise, replacing specimen holders is an undesirable expense. Although many technique-oriented aspects relating to SEM equipment and equipment care are well documented (e.g., Whitcomb 1981, Murphy 1982), the removal of double-stick carbon tape and its residues from SEM specimen holders has not been formally address

To this point, there has been lively discussion of this problem on the Internet (Microscopy ListServer 1997-2002). Recommendations have included: (a) various solvents (e.g., acetone, chloroform, heptanes, hexanes, methanol, naphtha, petroleum ether, pure and mixed acids, toluene, and xylene); (b) detergents (e.g., liquid dish soap, eucalyptus oil, and cold and hot water); and (c) commercial cleaners (e.g., Microsolution, WD-40, Goof-off paint/label remover, rubber cement thinner, Skelly B [hexanes], Limonene, Goo-begon, histolene, Ease-Away, and Tilex Soap Scum Remover). Most of these products require sonication. Internet recommendations have also included techniques for physically removing carbon tape

(e.g., sandpaper followed by acetone treatment, buffing on a grinding wheel, filing with medium-fine flat files, muffle furnace heating at 400-550°C, and plasma etching). Obviously, all of these proposals have met with individual success and were presented by means of the Internet in a casual, unconstrained format.

In this article, we present a successful and repeatable procedure for removing double-stick carbon tape from SEM specimen holders. This procedure is simple, fast, inexpensive, and uses materials readily available in SEM laboratories.

MATERIALS and METHODS

Double-stick carbon tape is removed by using a wooden dowel (15-20 cm long x 1 cm diameter, one end sharpened like a blunt chisel, the other end fitted with a collar of latex tubing to cushion pressure on the hand, Figs. 1A, B). Also required: beaker, ultrasonic cleaner, fume hood, Formula 409 (The Clorox Company; Oakland, California), and methanol. Optional (for highest quality results): a commercial metal polish [e.g., Pikal Metal Polish (Nihon MaryM-KMgyM Co., Tokyo) or Pol Super blau Universal Metallputz (Ted Pella, Inc.; Redding, California)]; along with cotton “Q-tip” swabs and a cotton twill cloth.

Our procedure:

(a) Place the dowel’s chisel end on top of the carbon tape, starting at the near end of the tape. With considerable downward force, move the dowel forward across the top of the tape (Fig. 1B). The tape will roll up on itself (Fig. 1B inset), forming a wad that is easily removed by hand. Repeat the forward stroke if necessary. (Because of the nature of the tapeís adhesive, it is not possible to achieve this result by attempting to slip the dowel between the tape and specimen holder.)

(b) Optional step (but one that we routinely employ): Place specimen holders on a cotton twill cloth. Polish specimen holders with metal polish dabbed onto the end of a cotton Q-tip (Fig. 1C).

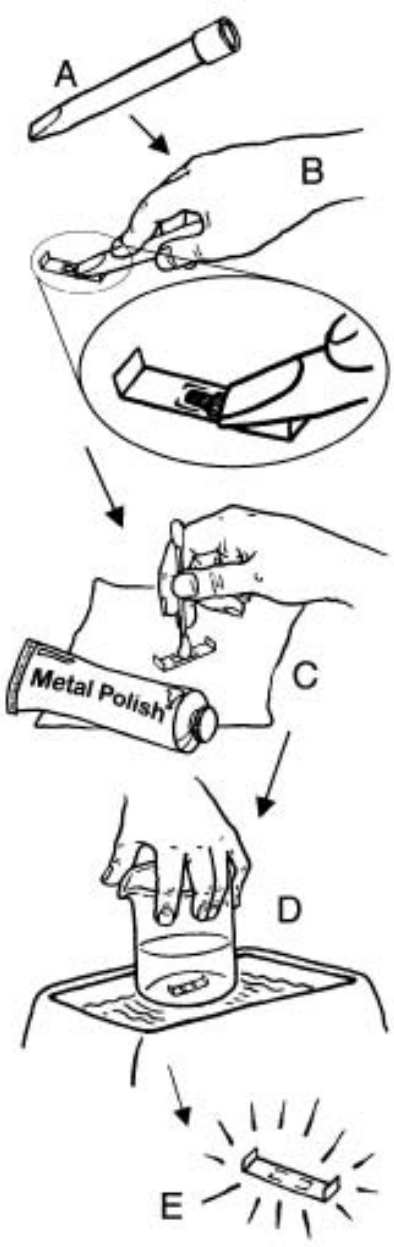

Figure 1. Removal of double-stick carbon tape from SEM specimen holder. A. Wooden dowel with one end chisel-shaped and the other covered with latex tubing. B. (including inset). Chisel end of dowel placed on carbon tape and pressed forward. C. Hand polishing of SEM holder on a cotton twill cloth with cotton Q-tip containing metal polish. D. SEM holder sonicated in Formula 409 to remove all traces of adhesive residue and metal polish. E. Cleaned SEM holder.

(c) Clean specimen holders by a single 10-min sonication in Formula 409, followed by a water rinse, and a final rinse in methanol (Fig. 1D). The sonication and methanol rinse may be conducted in a fume hood.

(d) After methanol treatment, allow specimen holders a few minutes to completely dry (Fig. 1E). After drying, specimen holders are ready for reuse. As recommended elsewhere (Murphy 1982), cleaned specimen holders should be handled only with lint-free gloves (or forceps) to prevent contamination from skin oils and stored in a dry dust-free environment (Murphy 1982).

RESULTS and DISCUSSION

The method described above has a 100% success rate, this based on 8 y of use in our laboratory. Advantages of this cleaning/recycling technique include:

(a) Reduced cleaning time: Double-stick carbon tape can be removed and several dozen specimen holders cleaned in approximately 20 min. Our “pre-dowel” cleaning procedures took at least twice as long.

(b) Economy: A chisel-shaped dowel can be fashioned at little or no cost. All other materials are readily available in an SEM lab and are used in small quantities. With the cost of copper specimen holders exceeding $1.00 each, it is possible to save $50-100 in much less than an hour.

(c) Safety: In an earlier version of this methodology, we used sonication in three solvents: toluene, acetone and methanol. While this was uniformly successful, our recent change to Formula 409 eliminated the use of two noxious solvents and their subsequent disposal, while further reducing the time and cost of the overall cleaning procedu

Although we have discussed and illustrated our procedure for rectangular copper specimen holders, we have had equal success with aluminum specimen holders of various designs. In addition, we have been uniformly successful in removing carbon tape when a variety of other materials (biological and non-biological) were mounted on the holders. Therefore, we believe that our method has universal application in scanning electron microscopy.

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