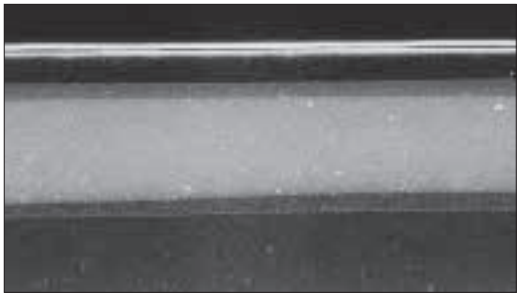
Polymers

POLYMERS

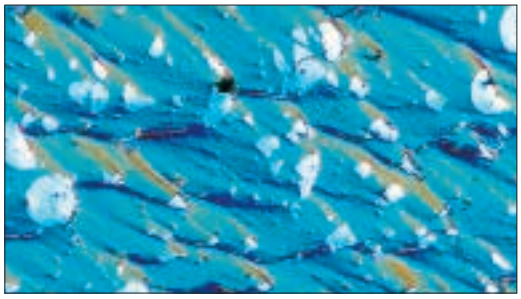
Plastics and polymers are normally quite soft. Many different sectioning methods have been used. A sharp razor blade or scalpel, or even a pair of scissors, can be used. Microtomes have been used, and a surface cut after refrigeration in liquid nitrogen requires very little subsequent preparation. A jeweler's saw may be used, although the surface is somewhat rough. The precision saw produces excellent surfaces, while an abrasive cut-off saw yields a bit more damage and a rougher surface. Blades and wheels for sectioning polymers are available from Buehler. Damage from sectioning is quite easy to remove.



Micrograph showing multi-layered polymer meat casing mounted in epoxy (dark field, 100X).

Surface quality can be degraded by abrasion from the debris produced during grinding and polishing.

Mounted specimens are much easier to prepare than nonmounted specimens. Castable resins are preferred as the heat from a mounting press may damage or alter the structure of the specimen. However, there may be a visibility problem if a transparent, clear polymeric specimen is mounted in a clear, transparent epoxy. In this case, EpoColor resin, with its deep red color, will produce excellent color contrast between specimen and mount in darkfield or polarized light. Due to their light weight, a specimen may float in the epoxy filled mold. To prevent this, put double sided adhesive tape on the bottom of the mold cup and set the specimen on top of the tape. Always use practices that minimize the exotherm during polymerization.



Micrograph of high-density polyethylene containing a filler (white particles) (unetched, Nomarski DIC, 100X).

Table 48: 6-Step Method for Polymers

Sectioning	Precision Saw with 30HC blade recommnded for polymers				
Mounting	Castable, typically EpoThin				
Surface	Abrasive / Size	Load - lbs [N] / Specimen	Base Speed [rpm]	Relative Rotation	Time [min:sec]
CarbiMet 2	320 [P400] grit SiC water cooled	4 [18]	300		Until Plane
CarbiMet 2	400 [P600] grit SiC water cooled	4 [18]	300		1:00
CarbiMet 2	600 [P1200] grit SiC water cooled	4 [18]	300		1:00
CarbiMet 2	1200 [P2500] grit SiC water cooled	4 [18]	300		1:00
TexMet C	3µm MetaDi II Diamond Paste*	5 [22]	150		4:00
MasterTex	0.05µm MasterPrep Alumina	3 [13]	150		3:00
= *Platen* = *Specimen Holder* **Plus MetaDi Fluid Extender as desired*					
Imaging & Analysis	Manual Interactive Thickness				
Hardness Testing	N/A				

Preparation of plastics and polymers for microstructural examination follows the same basic principles as for other materials. Automated polishing devices are preferred to manual preparation. Rough grinding abrasives are unnecessary, even for the planar grinding step. Pressures should be lighter than used for most metals.

Water is generally used as the coolant, although some plastics and polymers may react with water. In such cases, use a fluid that will not react with the particular plastic or polymer. Embedding can be a problem with plastics and polymers. ASTM E 2015 (Standard Guide for Preparation of Plastics and Polymeric Specimens for Microstructural Examination) describes procedures for preparing several types of plastics and polymers. Table 48 contains a generic procedure for preparing many plastic and polymeric materials. Depending upon the material and the surface roughness after sectioning, it may be possible to start grinding with 400 grit [P600] or even 600 grit [P1200] SiC paper.

If flatness is critical, the final step can be altered. Use a TexMet pad with MasterPrep alumina abrasive slurry at 10 lbs pressure [44N] per specimen, 120 rpm, contra rotation, for 3 minutes.

Helpful Hints For Polymers

Plastics often have little contrast from the mounting media when viewed under a microscope. This makes thickness measurement and discerning edges difficult. Mounting in EpoColor dye enhanced epoxy will resolve this situation by producing excellent color contrast between the specimens and mount.

Polymers and plastics may react with fluids during sectioning and preparation. Always check your particular polymer and choose the proper fluid, usually a water, or oil based solution to avoid a reaction.