Imaging Mechanisms in Dynamic Force Microscopy of Polymers

Continued from preceding page

to adhesive behavior). At amplitudes producing both non-contact and intermittent contact (c,d), height artifacts are manifest. In amplitude images the boundary between sub-domains imaged in nominal non-contact and those imaged in intermittent solid contact deviates substantially from the otherwise constant value. This is a diagnostic signature of a transition between interaction regimes. Under uniform intermittent solid contact at 64-90 nm amplitude (*e.g.*), lower phase indicates more energy-dissipative sample response.[14,15] On PVA this most likely reflects more amorphous sub-domains (PVA typically is semicrystalline[18]) of lateral size 20-30 nm. One must realize that even though all regions are imaged in intermittent solid contact, the height images remain convolutions of true height and amplitude damping. The impact of variable amplitude damping is small here, but may be large on softer, *i.e.*, rubbery, polymers. ■

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Thoughts About Waste Disposal and Regulations

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First, it matters not a bit what others are doing, even if they are doing it with the full knowledge and permission of their wastewater treatment officials. This is because every treatment plant is different, and must set its own limits on chemical waste. Approval must be obtained from local officials.

Getting permission from one's own group of officials may be a pleasant or difficult experience, but the way can be eased a bit by being prepared. Realize that most of them do not know what our histological chemicals are, so provide them with the OSHA mandated hazard codes (*e.g.*, flammable, corrosive, carcinogenic, etc.). They also want to know flash point, pH, miscibility with water and odor (if strong).

Picric acid, Bouin's and any solutions turned yellow by these substances must never be discarded down the drain, as the picric acid can form potentially explosive compounds with metal in the plumbing. A plumber twisting off a union or joint encrusted with these compounds could be seriously injured or killed.

Precipitating heavy metals is a good way to reduce the volume of hazardous waste (if the metal is the only hazardous component), but procedures vary with the element. Some metals fall out of solution at about pH 7 and stay out as the pH is raised (most will redissolve at lower pH); others precipitate at pH 7 but redissolve at higher pH (above 9 or 10). Yet others remain in solution regardless of pH.

I strongly recommend reading *Prudent Practices for Disposal of Chemicals from Laboratories* (National Academy Press, Washington, DC). Over 50 metal ions are listed, with the proper pH range for precipitation given for each. More specific directions are given for precipitating metals common to histology in our book. *Hazardous Materials in the Histopathology Laboratory* (3rd edition).

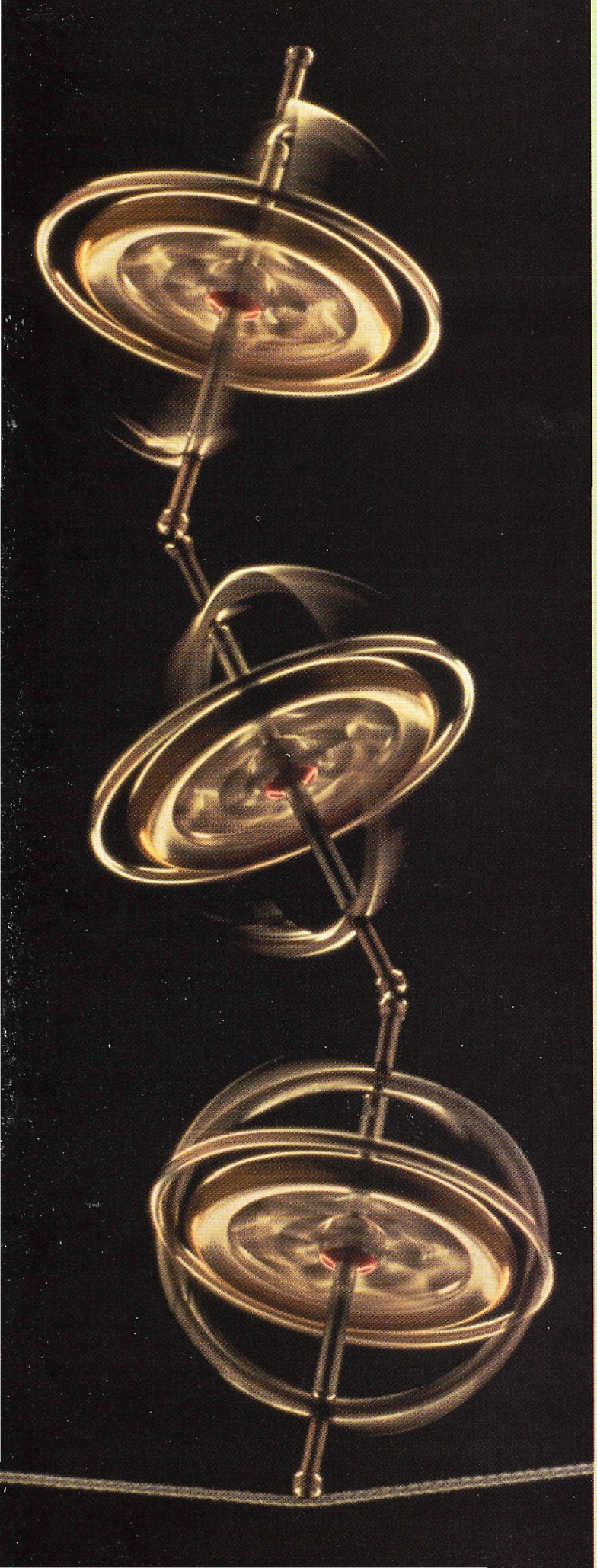
There is no practical way to reclaim the precipitated metal for reuse in the laboratory. Mercury and silver can be reclaimed, but only by commercial entities.

There are two sets of hazard codes: OSHA codes and NFPA codes.

OSHA codes are easy: most of them should be part of the label on the bottles. If not, the MSDS might list them. If all else fails, the MSDS should have enough information for the code to be determined. Definitions are straightforward; see *Hazardous Materials in the Histopathology Laboratory* (3rd edition), pages 107-115 for details. Incidentally, our book also gives these codes for most chemicals of histological/cytological interest.

If NFPA codes are desired, your problems are insurmountable. NFPA codes are intended to be used by firefighters involved in chemical fires or in building fires with burning chemicals. The codes are the hazard ratings for select chemicals under conditions of fire (very high heat, possible exposure to water, actual combustion). They definitely are not the hazards of the chemicals in normal use at room temperature.

Very few chemicals have been rated by NFPA. Anyone wishing to determine what the rating might be for a non-listed chemical must make informed inferences. NFPA definitions are rather vague and very difficult to fit to particular reagents. Few MSDS's contain this information for that reason. ■



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