1120 Via Callejon ■ San Clemente ■ California ■ 92673 ■ USA
Telephone: (949) 492-2600 ■ Fax: (949) 492-1499
e-mail: info@southbaytech.com
www.southbaytech.com

Ion Shadow-Digging

The technique of Ion Digging was developed for cross sectional TEM sample preparation by Masahiro Kawasaki et al. in 1999[1]. The technique employed using a relatively thin sample (~200 µm) and placing small diamond particles on the surface of the sample. An ion beam directed normal to the surface used the diamond particles as a mask to ion sputter, i.e. ion dig, the film/substrate surrounding the diamond particles. The difference in sputter yield between the diamond particles and the film layers was sufficient to allow the sample to become electron transparent under the diamond particle in the thin direction of the sample when viewed in the TEM in cross section. The diamond particles were dispersed by casting a dilute solution of diamond particles (0.2-0.5 µm) in ethanol onto the surface. This same concept can be used to examine films in the SEM and measure the thickness of the films. Instead of normal incidence, the ion beam is brought in at a shallow angle relative to the surface. It also helps to rock the sample to some angle to avoid curtaining effects. An example of a Low-E coating on glass examined with this technique is shown in Figure 1. In this example, a thick layer of gold was first deposited on the top of the sample prior to the diamond particles being put on the sample. This was done to give contrast with the film and delineate the surface interface of the film.

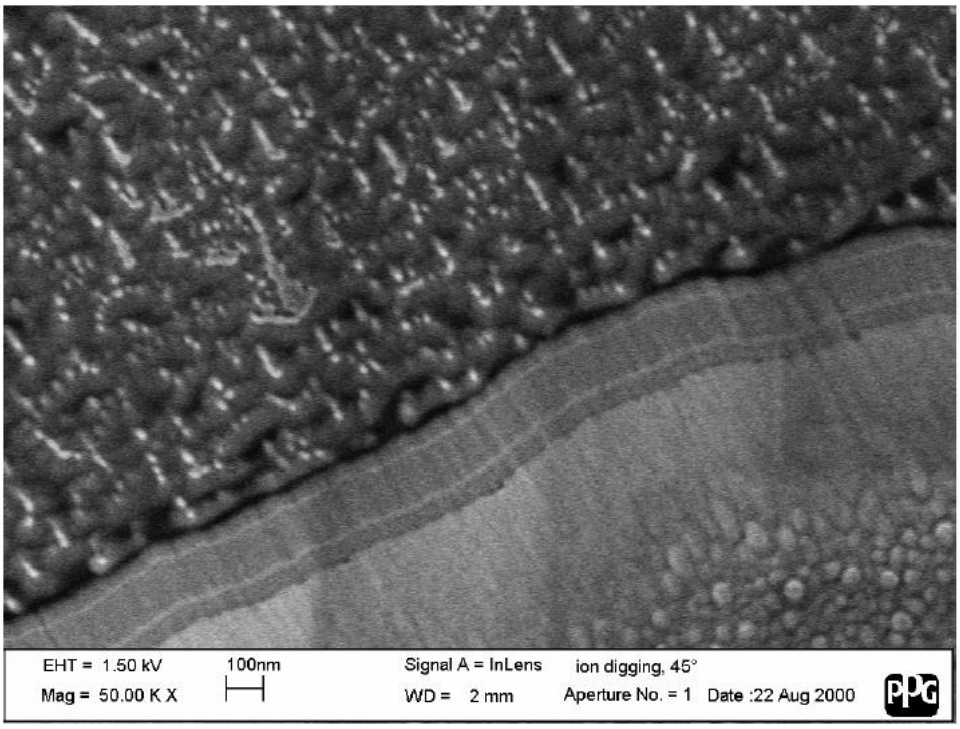

Figure 1 Low-E coating on glass that was ion cut using a diamond particle mask.

Figure 2 shows a smaller diamond particle in which the diamond particle has lifted partically off. Because of the oscillation of the sample relative to the beam, The film has one direction in which the length of film is better revealed and the layers are the widest. This reveals the disadvantage to this technique.

A better approach would be to use a straight edge across the sample such that all of the layers would be parallel.

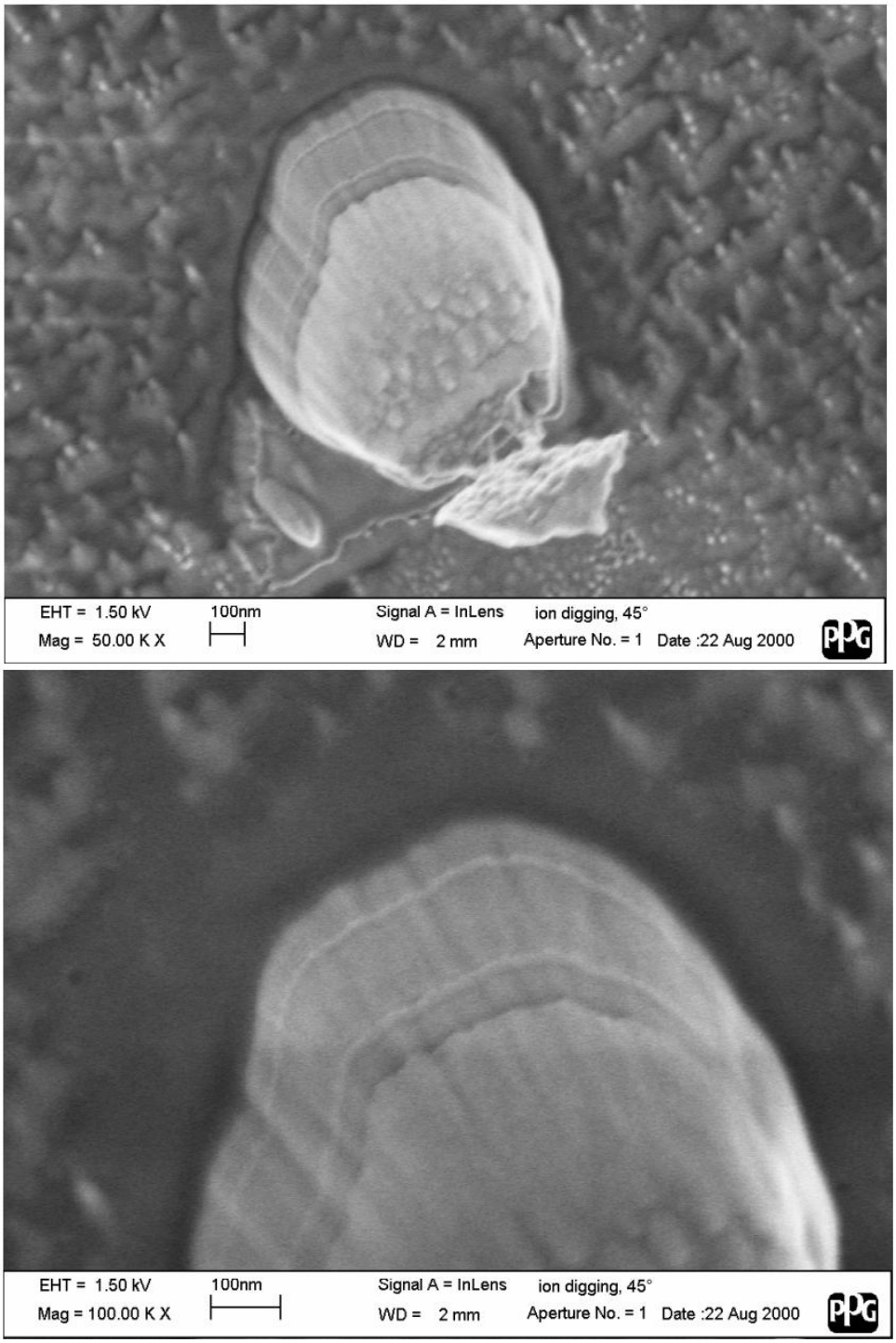

Figure 2 Small diamond particle showing the shadow masking by the particle.

References

1. Masahiro Kawasaki,Tadanori Yoshioka, and Makoto Shiojiri, *A New Specimen Preparation Method for Cross-Section TEM Using Diamond Powders*, Journal of Electron Microscopy 48(2), pp. 131-7 (1999).