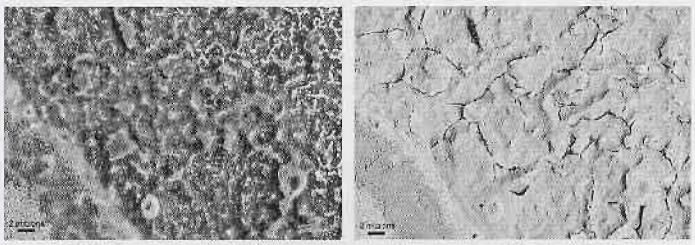
THE LOW VOLTAGE SEM IMAGING ADVANTAGE: A REMINDER

Steven S. Hurban

Endicott Interconnect Technologies, Inc. Endicott, NY
shurban@eitny.com

Recently, when faced with a problem involving inhibited nickel/gold over-plating on copper surfaces, a real life example showing the advantage resulting from use of low incident electron beam voltage in the SEM became apparent. This will serve as a reminder to explore variable SEM incident beam energies during analyses to enhance specific features.

During a manufacturing process, incomplete coverage of over-plated metals on copper was found. Initial optical examination of the condition suggested the presence of a residue. If true, and depending on the properties of the residue, it could inhibit or even prohibit proper over-plating coverage. SEM analysis was undertaken to prove or disprove the presence of a residual surface layer. Initial SEM inspection at 20keV proved inconclusive. It was noted that it was difficult to clearly focus the areas in question, which could be an indication of a thin surface film being present.



SEM image pair: left image – area of interest at 20keV, right image – same area at 5keV

Lowering the SEM incident beam voltage will decrease the total specimen/beam interaction volume and, thus, dramatically increase the contrast contribution originating in any thin surface film that might be present. The incident electron beam voltage was reduced to 5keV from 20keV in this examination. That reduction in beam energy resulted in clearly showing a cracked, thin film residue on the copper surface as seen in the figures. Once this condition was observed, the issue of improper over-plating coverage became clear. The unexpected film acts as a mask on the copper surface and inhibits or prevents the formation of viable subsequent plated layers.

This example is a striking illustration of the low voltage advantage. Using a higher beam voltage might have resulted in the surface film going unnoticed. Taking the time to investigate possible surface features with a lower energy accelerating voltage allowed us to image the problem film.