PHYSICAL ELECTRONICS
A DIVISION OF ULVAC-PHI

Determining Solder Ball Surface Chemistry with a PHI Scanning XPS Microprobe

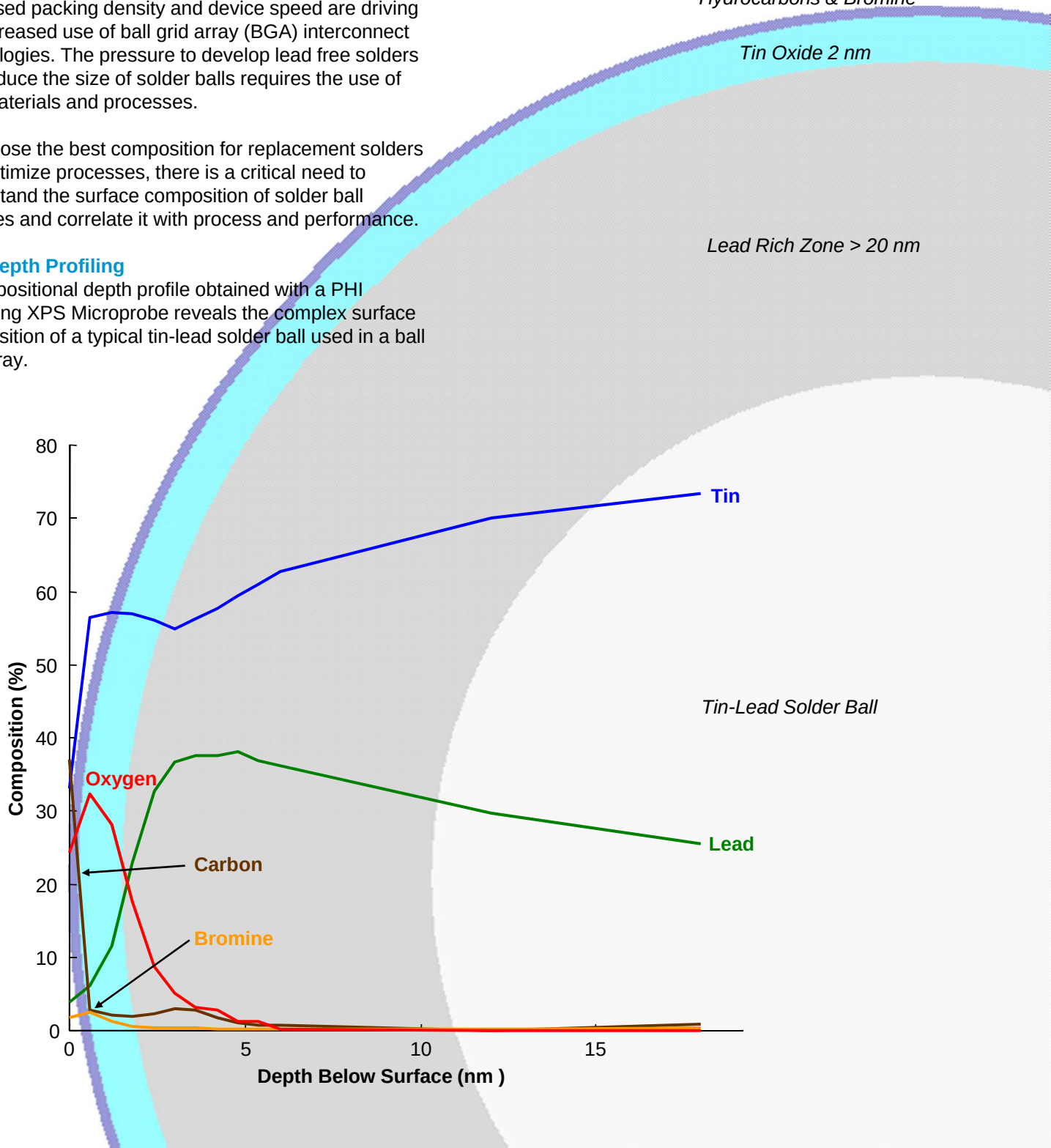
Introduction

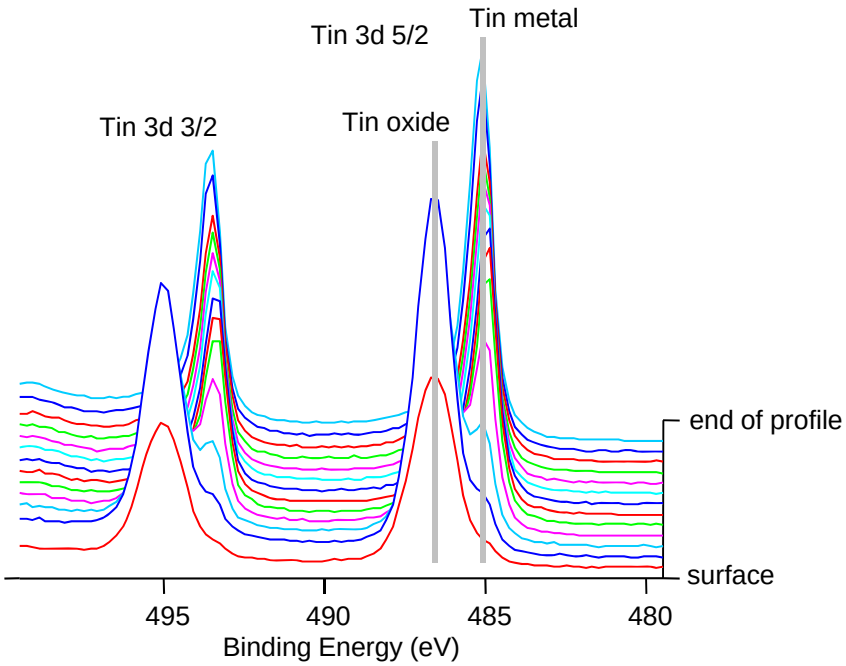
Increased packing density and device speed are driving the increased use of ball grid array (BGA) interconnect technologies. The pressure to develop lead free solders and reduce the size of solder balls requires the use of new materials and processes.

To choose the best composition for replacement solders and optimize processes, there is a critical need to understand the surface composition of solder ball surfaces and correlate it with process and performance.

XPS Depth Profiling

A compositional depth profile obtained with a PHI Scanning XPS Microprobe reveals the complex surface composition of a typical tin-lead solder ball used in a ball grid array.





Montage plot of tin spectra from the depth profile showing the presence of a tin oxide surface layer

Summary

The high micro-area sensitivity provided by PHI Scanning XPS Microprobes creates a new opportunity to use XPS depth profiling for the characterization of small features and thin films. In this example, a thin hydrocarbon film and a small amount of bromine were detected as surface contaminants. The depth profile showed that tin migrated to the surface and formed an oxide layer, leaving a lead rich (tin depleted) zone below the surface.

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