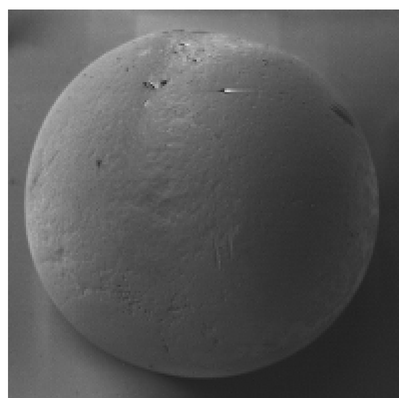
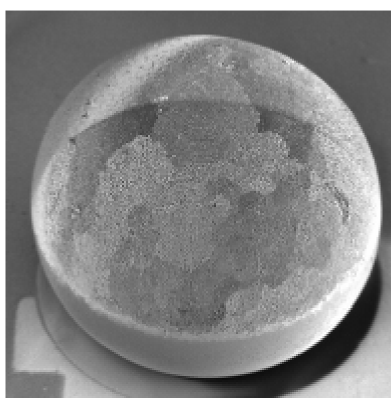
OREGON PHYSICS

NEWSLETTER - December 2007

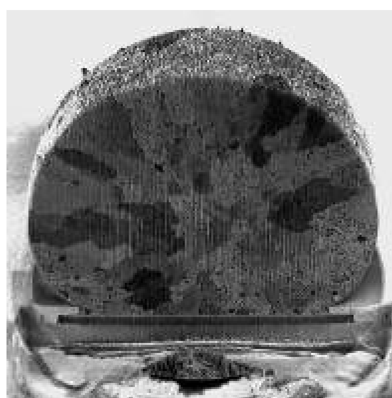
New Lab Service brings the speed and precision of focused ion beam milling up to the dimensions needed by the IC packaging industry... and leaves the high cost behind.



In-situ, 750μm diameter flip chip solder ball



After 6 hours of conventional FIB milling



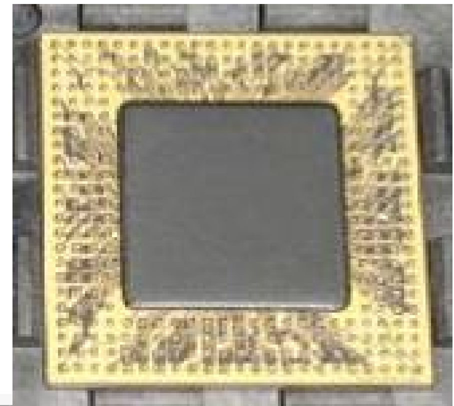
After 6 hours of Oregon Physics FIB milling

In 6 hours the Oregon Physics FIB has fully prepared the solder ball for analysis, removing approximately half of the ball. The conventional FIB tool has removed <1% of the ball making this type of analysis prohibitive with 600 hours of milling still required.

Oregon Physics LLC is pleased to announce the inception of its **Focused Ion Beam (FIB) machining service laboratory**. We offer FIB services for a wide array of industries that include semiconductor, electronics, magnetic storage, automobile, aerospace, metallurgy and MEMS. Our focused beam milling and imaging service helps industries in the development of new processes, understanding yield and failure issues and prototype device editing.

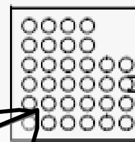
We are committed to providing customer confidentiality, careful attention to expectations and goals, along with timely and professional service.

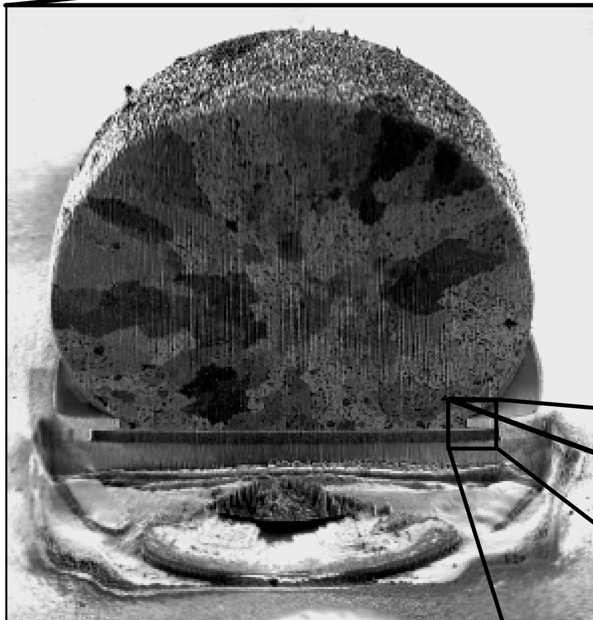
DEVICE PACKAGING

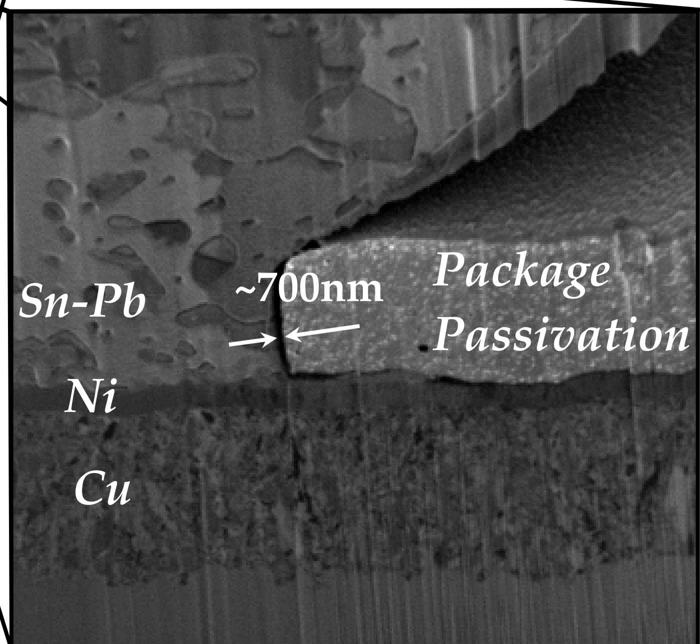


Our high mill rate ion beam system is capable of carrying out failure analysis on macroscopic structures with nanoscopic precision. The photograph shows an RM7000-266T microprocessor package that has not undergone any mechanical or chemical preparation steps before this analysis. In this example, a 750µm diameter solder ball from the Ball Grid Array (BGA) has been cross-sectioned to reveal the grain structure of the metallic solder ball and also the sub-surface interface with the integrated circuit.

Here, ~250x10^6 µm^3 of material has been precision milled from an in-situ I/O power (V_{SS}IO). The cross-sectioned solder ball delivery bump and Under Bump Metallization (UMB) pad are imaged by tilting the sample towards the beam and imaging the cross-sectioned face at a 45^0 incidence angle. The FIB images so no evidence of UMB delamination from the solder, with good adhesion of the Sn-Pb solder ball to the nickel interface layer, and between the nickel layer and the underlying copper. However, a non-critical 0.5-1.0µm gap does exist where the package passivation layer meets the solder ball.







The lack of mechanical or chemical sample preparation has prevented any structural defects from being created in the analysis process. Material chemistry has been determined via post cross-sectioning Energy Dispersive X-ray Analysis.

Aside from this laboratory service, Oregon Physics develops next generation charged particle optics and ion source technology for a variety of applications including FIB, secondary ion mass spectrometry (SIMS), ion scattering spectroscopy (ISS), high energy accelerators and nuclear fusion applications. We also provide consultation to other analysis labs and charged particle beam instrument developers requiring modifications to their instrumentation for performance optimization, lifetime enhancements or re-engineering for ease-of-manufacturing and quality improvements.

We believe our breadth of experience in this field offers a unique insight into the optimal use of this technique for difficult and non-routine sample work in our service laboratory. If you would like to explore the use of our laboratory to solve your material issues, please contact Oregon Physics with questions, advice or to request a quote for services.

In the coming months, we'll be announcing the addition of further material analysis capabilities, as well as more about our design expertise in charged particle optics.

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