international TEST SOLUTIONS	**Probe Clean™**	**Technical Brief**

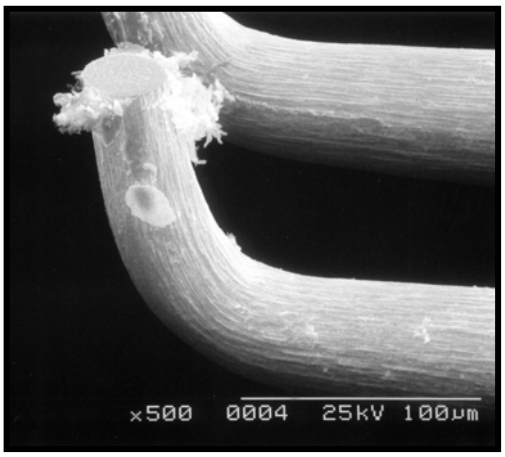
Non-Abrasive Method to Clean Loose Debris from Probe Tips

Unstable contact resistance (C_{RES}) during wafer level test can significantly impact wafer yield, increase the need for re-probe and reduce equipment uptime. Fundamentally, contact resistance during wafer test is greatly influenced by probe tip contact surface cleanliness, e.g., the presence of adherent particulates, probing debris and aluminum "tails", passivation and etch residues, and various surface contaminants. Through trial and error, various online abrasive cleaning methods using alumina (aluminum oxide) lapping films, tungsten carbide disks, or ceramic plates have been developed to keep the probe contact surface clean and control the C_{RES}.

Each time the probe tips are cleaned with an abrasive medium a small amounts of material are removed and the tips are subjected to frictional shear stresses. Particulates, bond pad metal, or probe material left on the abrasive pad from previous cleanings can adhere to the probe tips and along the tip length.

Particulates and debris generated during a cleaning operation on a typical 3-um grit lapping film are shown in the figure.

After repeated abrasive cleanings, the tip diameters of cantilevered probes can become too large for the bond pads due to the tapered design and the reduced tip lengths affect the probe card planarity and alignment.



Tungsten-rhenium probes "cleaned" with 3-µm grit alumina lapping film ("pink stuff")

Many of the next generation and high dollar probe card technologies such as those developed by FormFactor and Cascade MicroTech for area array, fine pitch, high frequency, and low-k dielectric devices cannot withstand the coarse deformation imparted by the surface of a burnishing pad. Simply, for such technologies, any sort of on-line abrasive cleaning operation is not a viable option. Off-line maintenance operations (such as brushing, ultrasonic immersion, etc.) to remove adherent debris can also increase the risk of accidental handling damage.

Probe Clean™ was developed to remove and trap the loose debris that accumulates on the probe tip, tip length, and electrical contact area of the tip. Typically, this sort of debris is generated as the probes make repeated contact with the devices under test (DUTs) during wafer sort operations. **Probe Clean™** is a highly, cross-linked polymeric material that can be mounted on substrates, wafers, and abrasion plates used for on-line and off-line probe cleaning. This unique cleaning material is non-conductive, non-corrosive, and has an effective operating temperature range of -50°C to +200°C. Furthermore, it does not leave any residuals on the probes or the bond pads (as tested using FTIR and XPS detection methods.)

The primary cleaning action with **Probe Clean™** occurs during a Z-axis (up and down) motion into the polymer material. Very low vertical forces are needed to penetrate the polymer surface and undesirable lateral or shear forces are not imparted on the probe or probe tip; thereby, eliminating potential probe damage and misalignment issues. **Probe Clean™** can be used to clean all types of cantilevered probe needle materials (i.e., tungsten, rhenium tungsten, beryllium copper, and palladium–alloy) as well as the more advanced vertical and area array technologies.

After multiple touchdowns on aluminum bond pads, various types of debris accumulate on a probe tip, tip length, and probe shaft. Not only can this debris reduce wafer yield, it can challenge the optical

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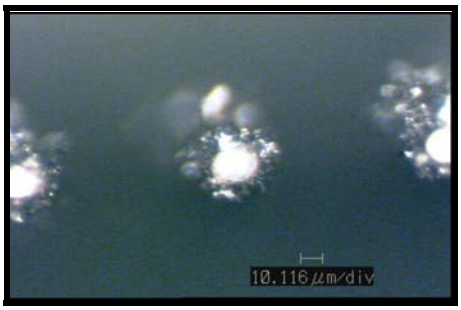
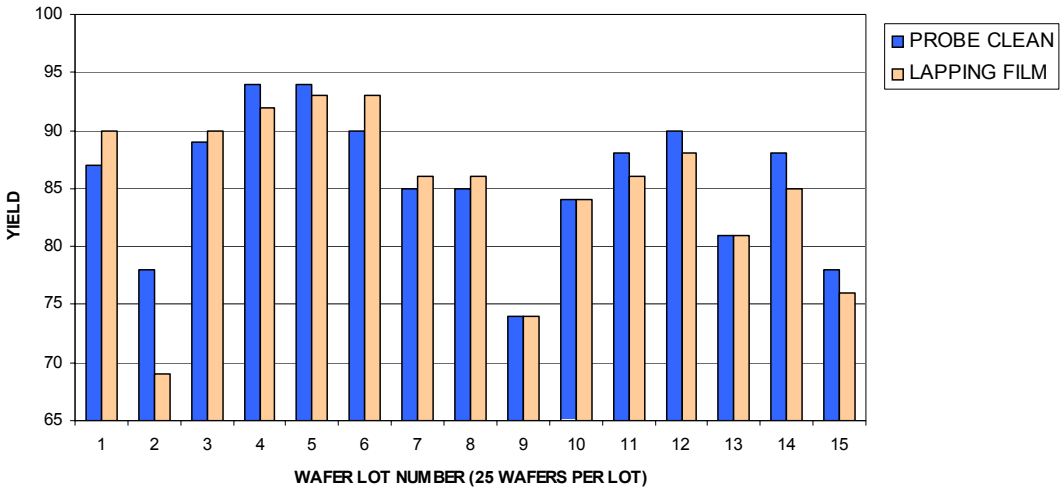
recognition algorithms of the prober; thereby requiring operator intervention and affecting equipment uptime. After five (5) insertions into the **Probe Clean™** material, all the loose debris has been completely removed from the probe tip and shaft of the probe. Collecting loose debris also reduces the test data scatter, allowing for tighter test specifications and test data confidence.



Probe tips before cleaning.
(Image from Accretech/TSK UF-200)

Probe tips after 5 Probe Clean™ insertions.
(Image from Accretech/TSK UF-200)

CASE STUDY – A customer wanted to assess the impact of consistent debris collection on wafer yield. 15 lots of 25 wafers (for a total of 375 wafers) were split between production setups using **Probe Clean™** and 3-μm grit, alumina lapping films. As summarized below, an overall increase wafer yield of approximately 1% increase was realized. In this case, frequent non-destructive cleaning was as effective as abrasive cleaning without damaging the probe cards.



Increased wafer yield were realized with regular use of Probe Clean™

To attain the maximum benefit from **Probe Clean™**, **International Test Solutions** recommends that the material is used regularly starting with new or refurbished probe cards to remove debris. Probe card cleaning frequency varies according to the specific testing environment. In fact, some users have reported cleaning as frequently as every 50 die touchdowns while others clean periodically at 4000 die touchdowns.

Contact **International Test Solutions (ITS)** directly or a local **ITS** distributor with your specific probe card cleaning requirements.

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