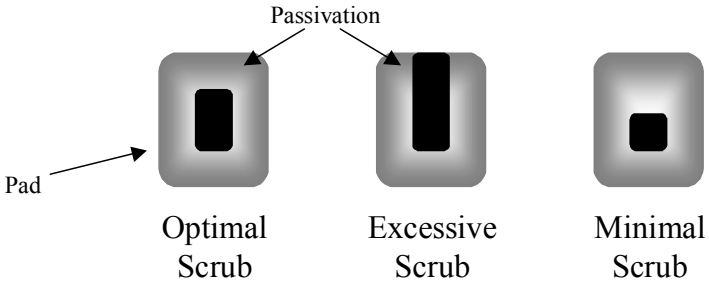
accuprobe

Probing the World of Microelectronics

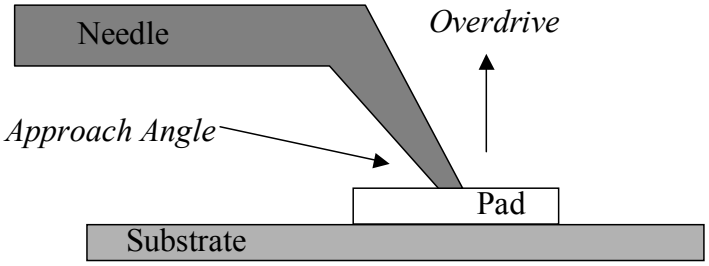
PROBE TIPS # 20 A Technical Bulletin for Probing Applications

MINIMIZING PROBE SCRUB

What is scrub? How does scrub happen? Is it good or bad? Scrub occurs during probing when the needle tip makes contact with the pad of the device under test (DUT) and overdrive is applied. The bend (approach) angle of the needle coupled with the length of overdrive dictates the amount of scrub that will occur. Some amount of scrub is necessary to break through oxidation or other barriers on the pad to ensure that a good electrical contact is made. Lack of scrub may mean that the needle angle is too high leading to gouging and damage to the pad of the DUT, or needle breakage. Excessive scrub may also cause the needle to exit the pad area into the passivation.



Why do you want to minimize scrub? The optimal amount of scrub ensures that good electrical contact is made with the pad of the DUT, minimal damage is made to the pad, and scrub is contained to the center of the pad within the limits of the device size, prober accuracy and probe needle planarity and geometric precision. Optimal scrub ensures optimal device yield. Excessive or non-optimal scrub could lead to pad damage and bonding difficulties later in the manufacturing process. Where wafer inking is in use, scrub outside of the pad area can also lead to ink pickup and travel negatively affecting the semiconductor manufacturing process. Minimal scrub may not break through any surface oxidation leading to deficits in electrical connectivity.

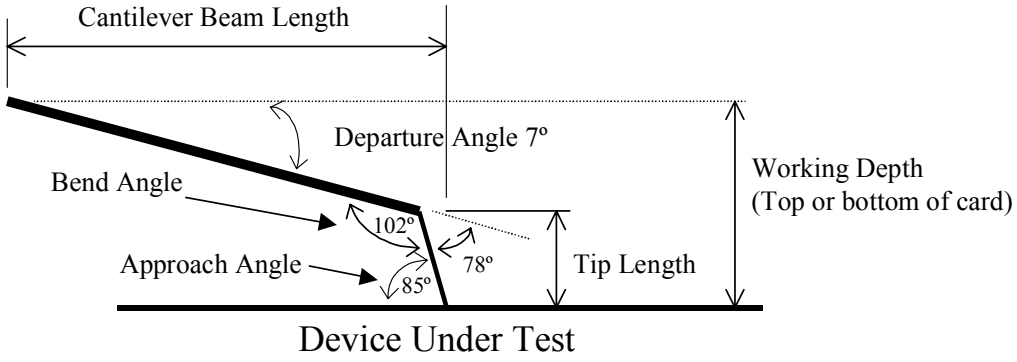


How do you minimize scrub? Three key factors allow you to minimize scrub in device test:

1. Choose the correct size and type of needle appropriate for the pad material and geometry.
2. Ensure that the needle tip bend or approach angle is optimized for the DUT geometry.
3. Apply the correct amount of overdrive for the system.

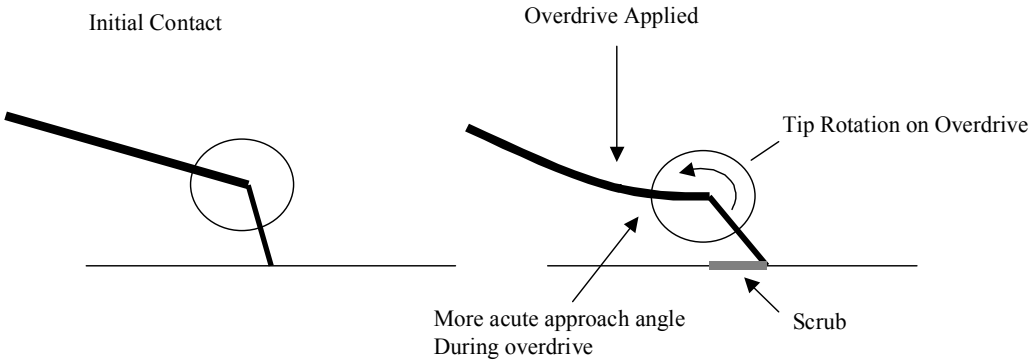
As a starting "rule of thumb" the probe tip diameter should be a maximum of 1/2 the pad size. Hence a 4mil pad should use at most a 2mil needle tip diameter. This is necessary because the coordinate accuracy of the probe card and needles as well as movement due to operation, requires some amount of leeway to ensure the targets are hit and for optimal performance of the probing system. Flat or radius tips may be used depending on the pad geometry and material. (See our companion Technical Bulletins on tip shape and size for additional information on this subject).

The angle of approach, which is dictated by the tip bend angle is a critical factor in scrub determination. Accuprobe recommends a standard tip bend of 78º (102º reciprocal) as shown in the physical dynamics diagram below for optimal probing.



Where very fine geometries need to be probed another possibility would be to use a special tip bend of 83º, which would result in a 90º-approach angle (less scrub) to the bond pad, assuming standard overdrive.

The final factor is the amount of overdrive that is applied to the system. The wafer sort industry standard is approximately 3mils or 75µm. There is typically a 10:1 ratio between the amount of overdrive applied and the length of the forward scrub motion of the probe needle. For example an overdrive of 3mils will lead to a scrub of 0.3mils. The more overdrive that is applied, the more scrub.



Summary

Careful attention to the mechanics of probing will allow the tester to minimize pad scrub and maximize DUT yield. Scrub needs to be at a level that allows the probe needle to break through any surface contaminates to ensure good electrical contact and low contact resistance. Delicate materials such as Gallium Arsenide and Silicon on Sapphire may require angle changes to maximize scrub and minimize overdrive. Selection of the correct needle for the pad material and geometry, a cooperative overdrive/tip bend relationship, as well as properly planerized and maintained probe cards are prerequisites for productive probing with minimal scrub.

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