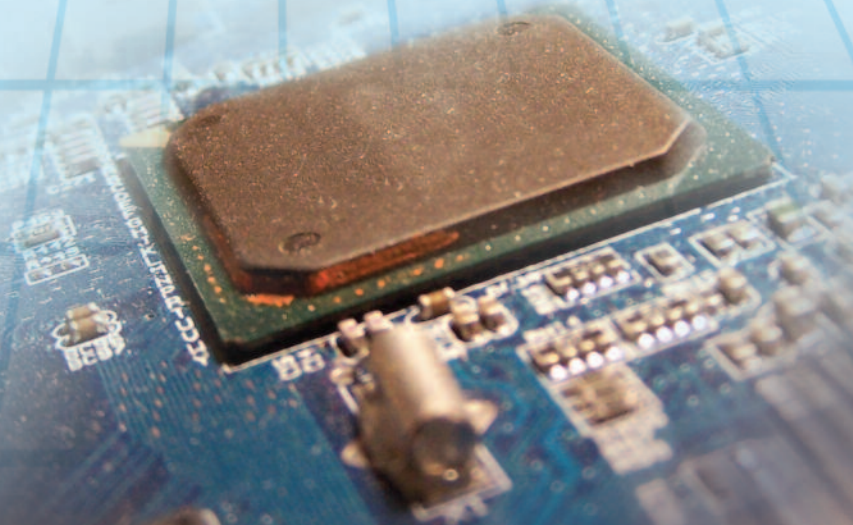




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# Decapsulation & Delidding of Electronic Packages Using the PetroThin



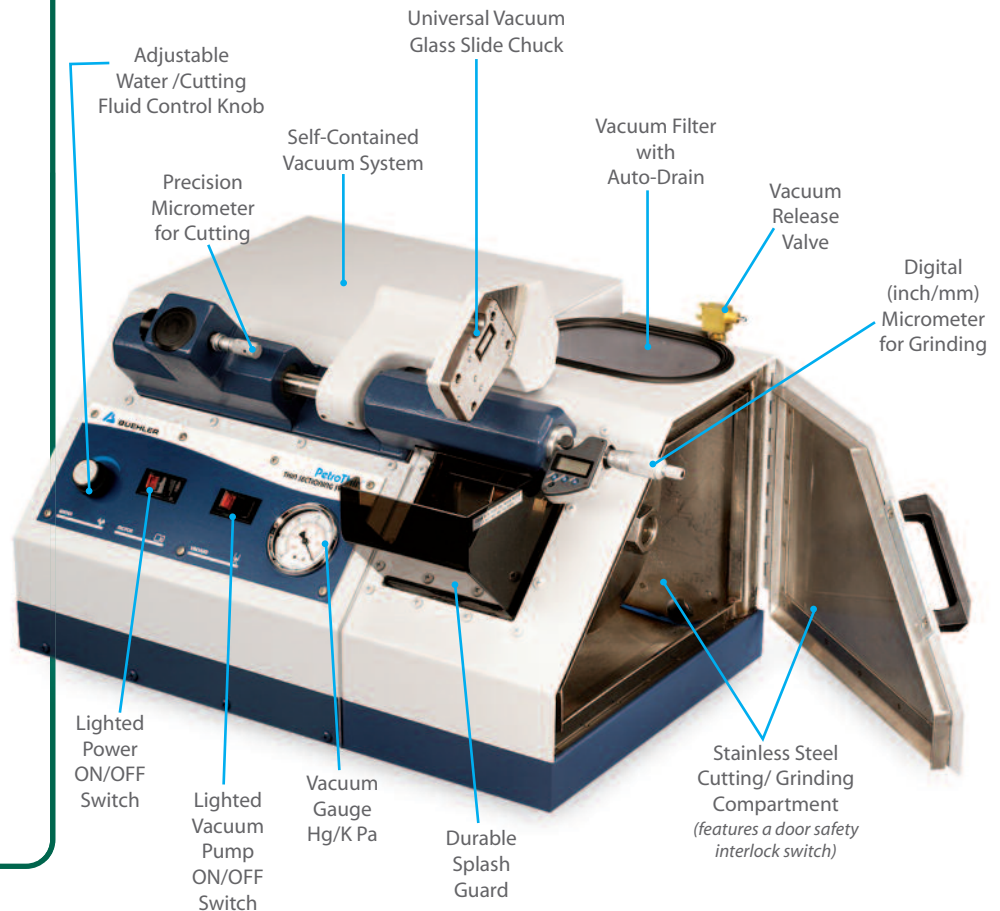
**Buehler is the Science Behind Materials Preparation and Analysis.™**

## PetroThin Advantages

Mechanical Decapsulation of microelectronic packages with the PetroThin offers numerous advantages.

- Metal and ceramic packages that are resistant to chemical attack can easily be prepared.
- Multiple packages can be decapsulated or delidded, at the same time.
- Decapsulate large packages up to 2"x 3" (5 x 7.6 cm) in size.

The PetroThin allows for a quick, accurate, and repeatable way of Decapping (thinning) before a final chemical etch. After using the PetroThin, chemically decapsulating packages takes less time. The PetroThin will prepare more than one package at a time (which shortens the overall preparation time), and removes chemically resistant materials.



Failure analysis is a vital part of semiconductor and electronics manufacturing. Diagnostic failure analysis tools provide essential information about a defect or failure so that a die failure can be localized and analyzed. Decapsulation or delidding is applied in order to gain access to a die or component in most cases encapsulated with a polymer. The die is then accessible so that it can be viewed and in some cases activated to conduct electrical measurement or verification. This technique is also being used to determine if electronic components may be counterfeit.

Decapsulation & delidding are performed by the removal of packaging material that covers the electronic circuit. Packaging material is made of a polymer, ceramic or metal alloy. Removing this can be performed mechanically, chemically (using acids) or with a laser or plasma system. Metal encapsulated packages are more easily removed by mechanical grinding. Some molding compounds are a mixture of cured epoxies and may be resistant to chemical decapsulation.

The PetroThin is ideal for removing these epoxies and metal covered packages. Multiple large and small size packages can be prepared at one time. The PetroThin enables a mechanical decapsulation method and can easily remove packaging material to within +5 microns of the circuitry. After any mechanical material removal method, chemical decapsulation or other techniques must be employed. Using a mechanical removal system does speed up the chemical treatment time, especially for chemically resistant epoxies.

### Electronic Package Mounting

Packages are mounted on a glass slide with Crystal Bond Mounting Wax. This is done with the aid of a hot plate. Gentle pressure is applied until the wax hardens and our PetroBond (#38-1490) is ideal for this application. As a rule of thumb, thickness of the wax is between 10-20 microns. Samples do not have to be perfectly aligned because chemical etching will remove any remaining material. Total mounting time varies and depends on the number of packages but normally can be completed within a few minutes.

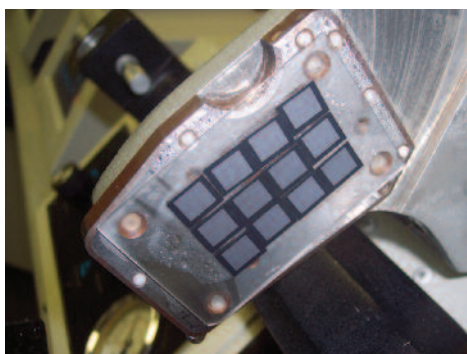


Multiple IC's are wax mounted on a glass slide

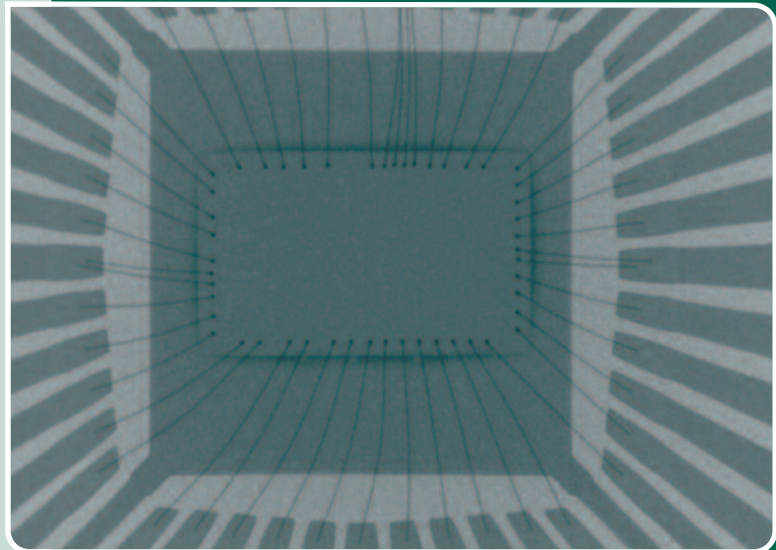
In this case, 12 of the same packages were

mounted on a

2" x 3" (5 x 7.6 cm) glass slide. After mounting, the slide was placed on the PetroThin holder and held in place by a vacuum.



The glass slide which is held by a vacuum is mounted on the PetroThin holder

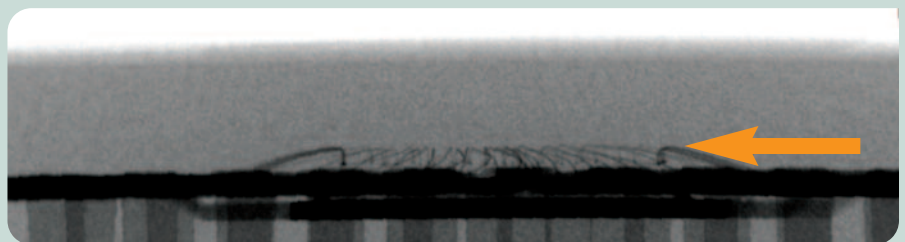


X-ray top view of chip. Notice the wire bonds.

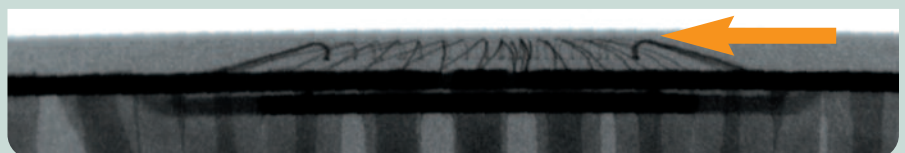
X-ray imaging can provide thickness measurements to determine how much packaging material should be removed.

Once mounted, samples are decapsulated (thinned) using only the diamond cup wheel. The cutting blade is not used in this application. When packages are mounted on the PetroThin, the micrometer is set to zero as the first package touches the cup wheel. After several passes across the cup wheel, move the micrometer approximately 10 microns. Keep thinning until the first circuit becomes exposed or you have removed the required amount of material.

The entire process from mounting to final thinning takes a few minutes. Removing the packages from the glass slide is accomplished by heating. Any remaining wax can be removed with a solvent such as ethanol.

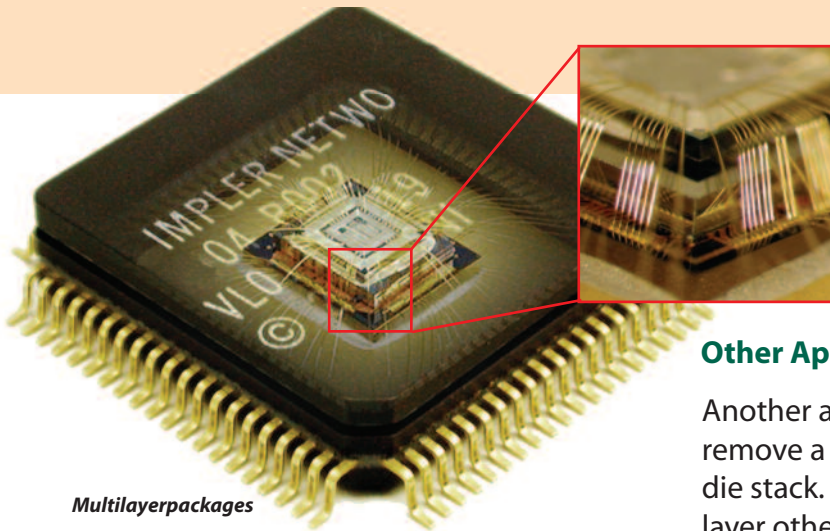
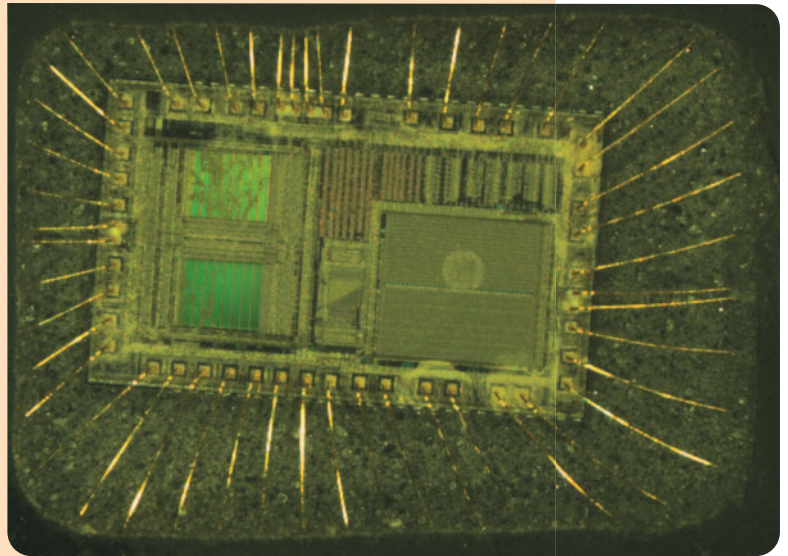


X-ray side view before thinning and decapsulating. Notice the wire bonds.



X-ray side view after thinning close to the wire bonds which are still in tack.

**IC top view after PetroThin decapsulation and chemical etching. Notice all of the wires remain intact and the chip is exposed.**



**Multilayer packages**

### **Other Application**

Another application would be to remove a chip layer from a multilayer die stack. If a failure is recorded in a layer other than the top layer then removing these layers would be the objective.

### **Additional Information**

Buehler's advertisements have appeared in Microscopy Today & Electronic Device Failure Analysis magazines. Visit the Buehler website: [www.buehler.com](http://www.buehler.com). For additional technical information, please contact us at [info@buehler.com](mailto:info@buehler.com).

*Buehler continuously makes product improvements; therefore, technical specifications are subject to change without notice.*

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