

# Indium bump liftoff using the MEI FluidJet

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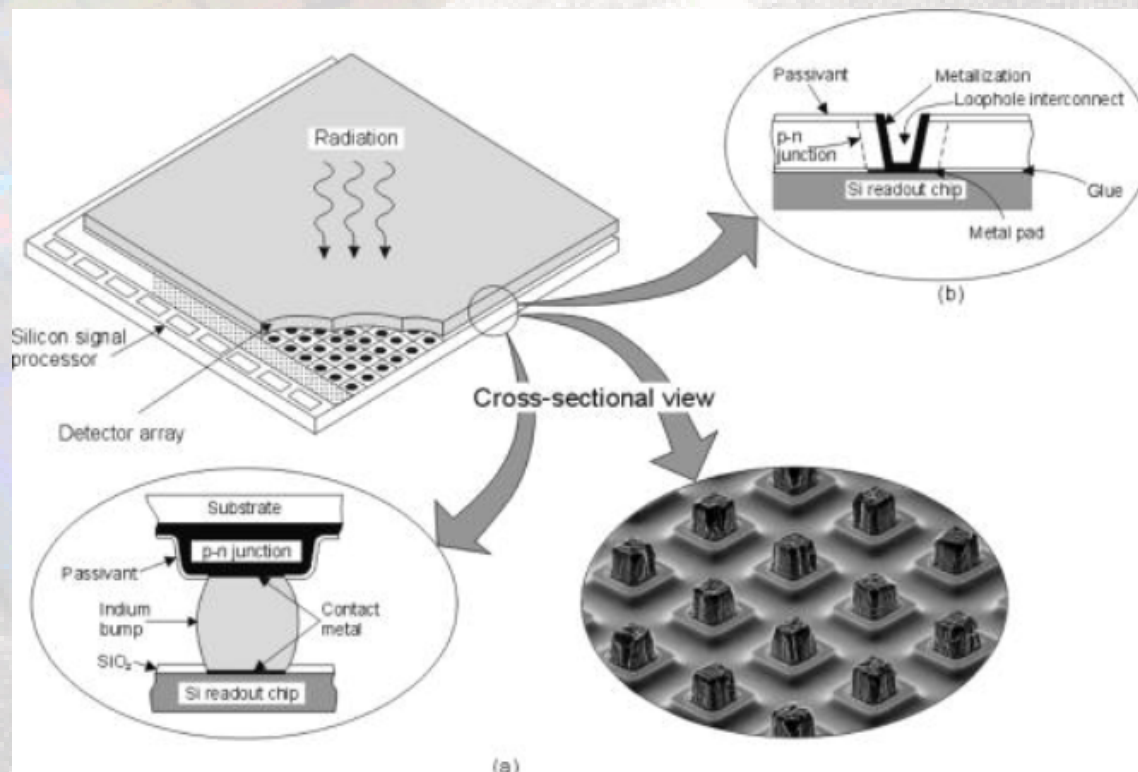
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# Indium Bump Overview

- High-performance infrared photodetectors operating in the range of 3–14  $\mu\text{m}$  are highly needed for a variety of applications, such as security surveillance, chemical sensing, and industrial process monitoring. This has promoted increasing research interest in new materials and structures to improve detector performances, such as spectral sensitivity, leakage current level, and operating temperature



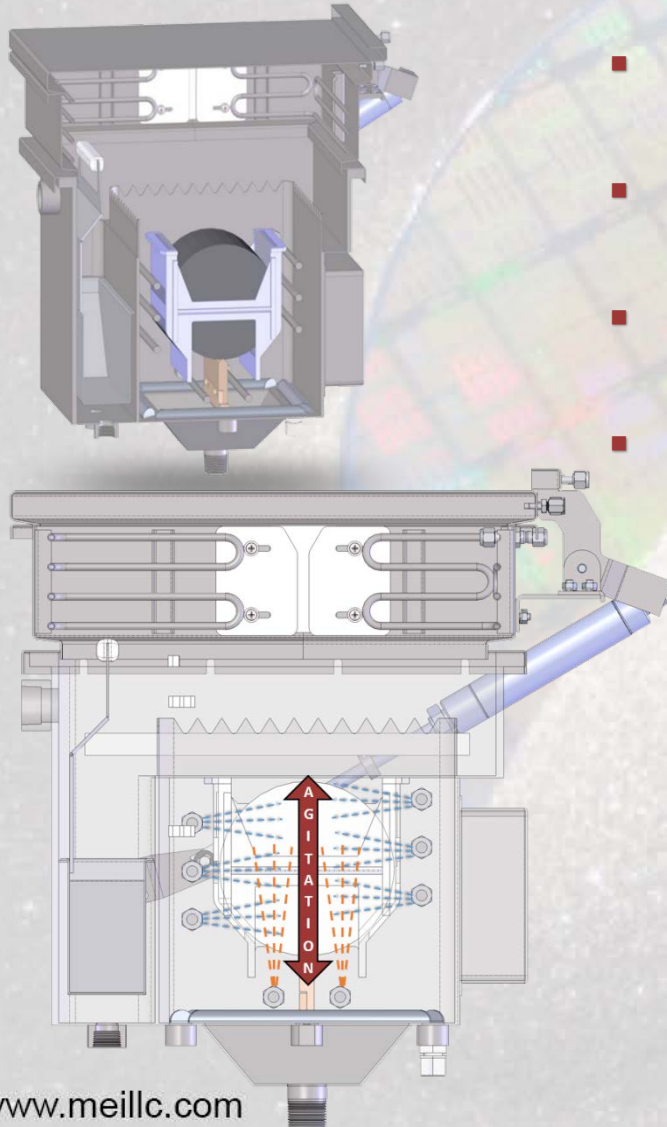
# Liftoff Challenges



- Indium bumps are extremely fragile
- Spray, Tape and Manual liftoff create severe damage
- Standard immersion systems leave metal between wafers which causes damage when removed
- Soaking and manual extraction are extremely slow with low device yield
- Limited budgets for equipment
  - Low volume production requires a lower cost system
- Production ramp is required
  - Driving inventive solutions to problems described above

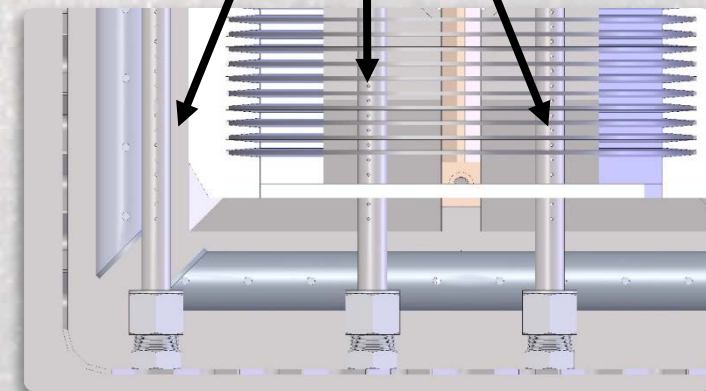


## FluidJet™ Design



- Provides metal removal utilizing precise hydraulic forces with robot agitation to maximize coverage
- Oscillating fluid forces to optimize metal removal from cassette
- Tank fluid flow balanced to maximize metal removal and achieve maximum metal cleanout
- Fluid flow modeled to specific field proven velocity requirements for stripping metal

Adjustable High-pressure  
spray bars between wafers



# NMP-Acetone-IPA – Marangoni or SRD

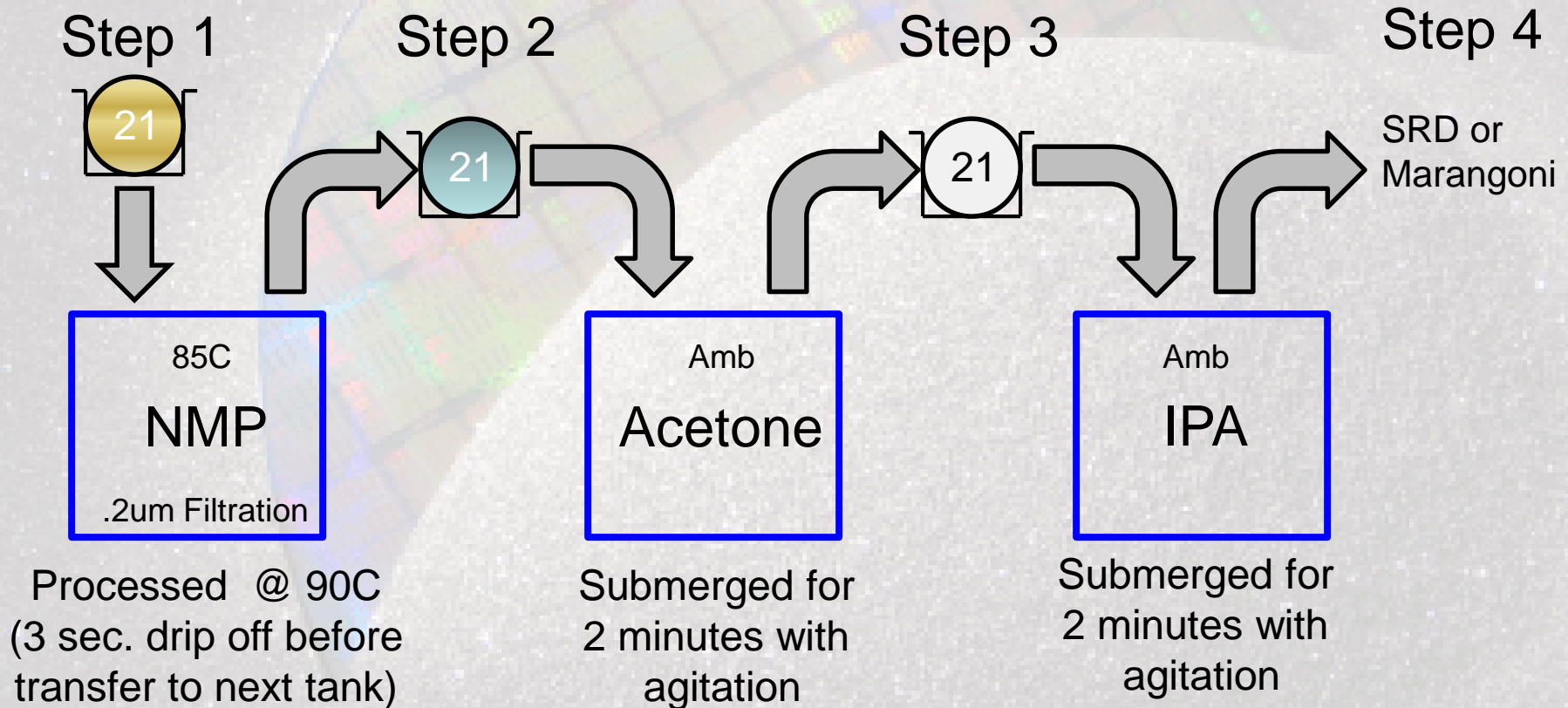
**Objective:** The test was conducted to evaluate if indium could be removed without causing damage to the sensitive structures below.

Test was performed using:

- ❖ MEI Metal lift tool for metal liftoff process w/NMP
  - ❖ SS Recirculated filtered tank for Acetone
  - ❖ SS Recirculated filtered tank for IPA rinse
  - ❖ DIW Marangoni dry
- ❖ This process testing was executed in the MEI LLC Applications Lab in Albany, Oregon in our Fluidjet system.

## NMP-Acetone-IPA MLO sequence

The Process:



# NMP-Acetone-IPA Indium liftoff

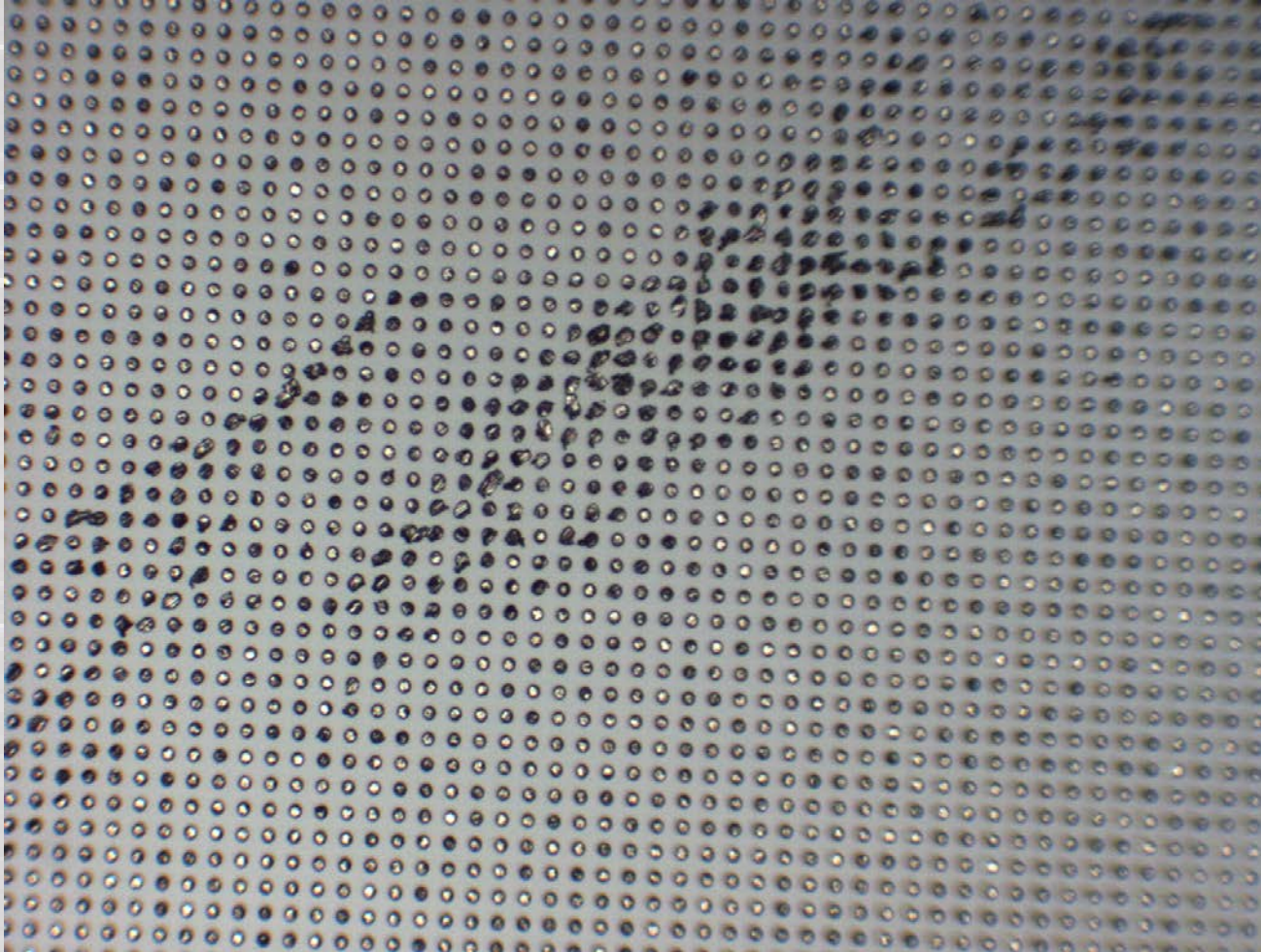


## FluidJet Recipe

- NMP Tank temperature set 90C, ALL Steps with robot agitation on.
- Soak time 20 Minutes 25% recirculation pump power, Sonics 100% @ 72kHz.
- Gentle Lift “Bottom Center” 15 minutes 20% Fluid jet power, Recirc. 25% power, Sonics 100% @ 72kHz
- Gentle Strip 10 minutes 20% Fluid jet power, Recirc. 25% power, Sonics 100% @ 72kHz 60 Sec Cycle on strip pumps.
- Strong Lift “Bottom Center” 15 minutes 50% Fluid jet power, Recirc. 25% power, Sonics 100% @ 72kHz
- Final Clean and Strip 30 Minutes 50% Fluid jet power, Recirc. 25% power, Sonics 100% @ 72kHz 60 Sec Cycle on strip pumps
- Followed by 2 Min Acetone rinse
- Followed by 2 Min IPA Rinse and Dry



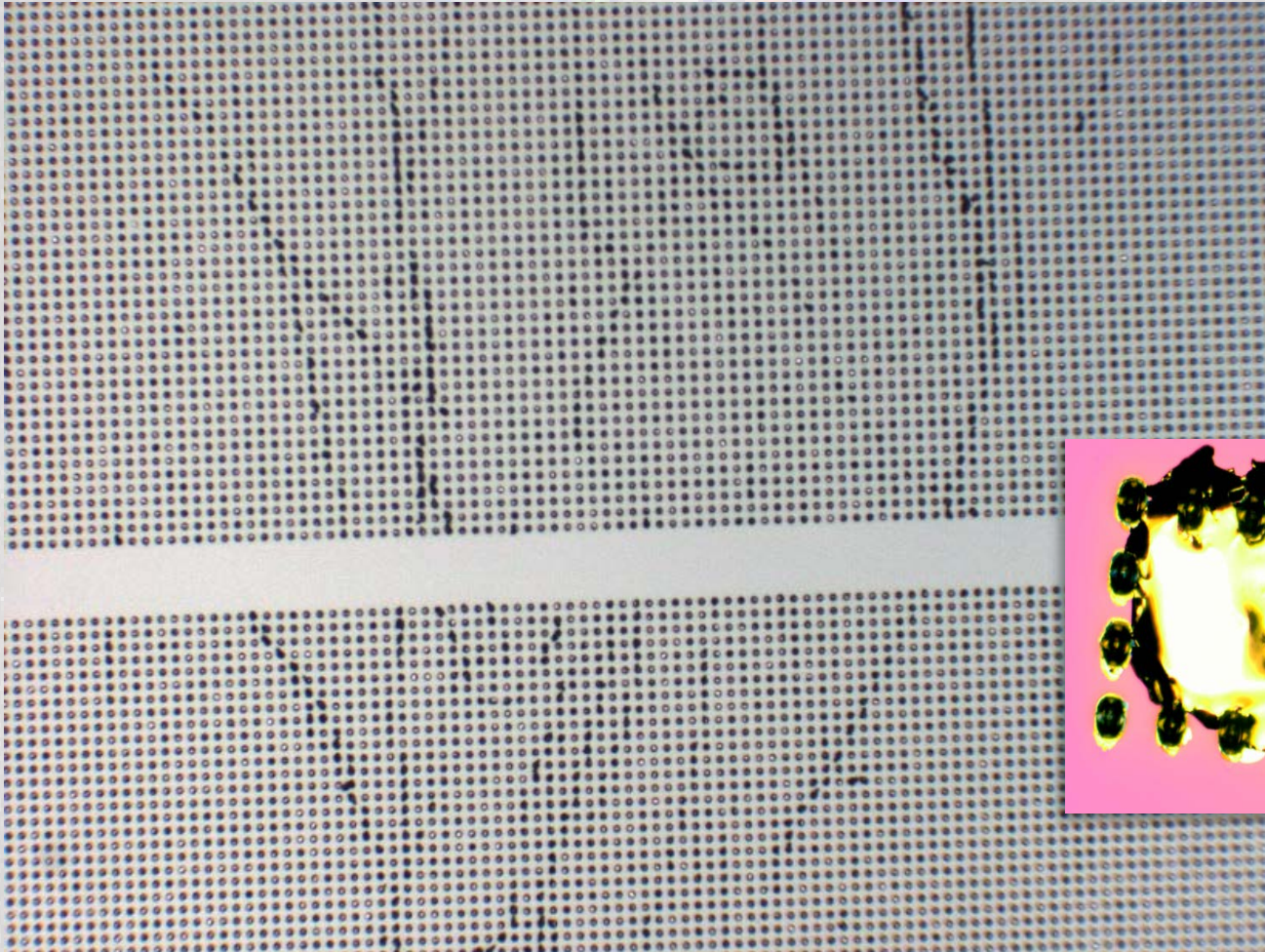
# Indium Bump Damage



Indium Bumps have smeared due to rapid metal removal



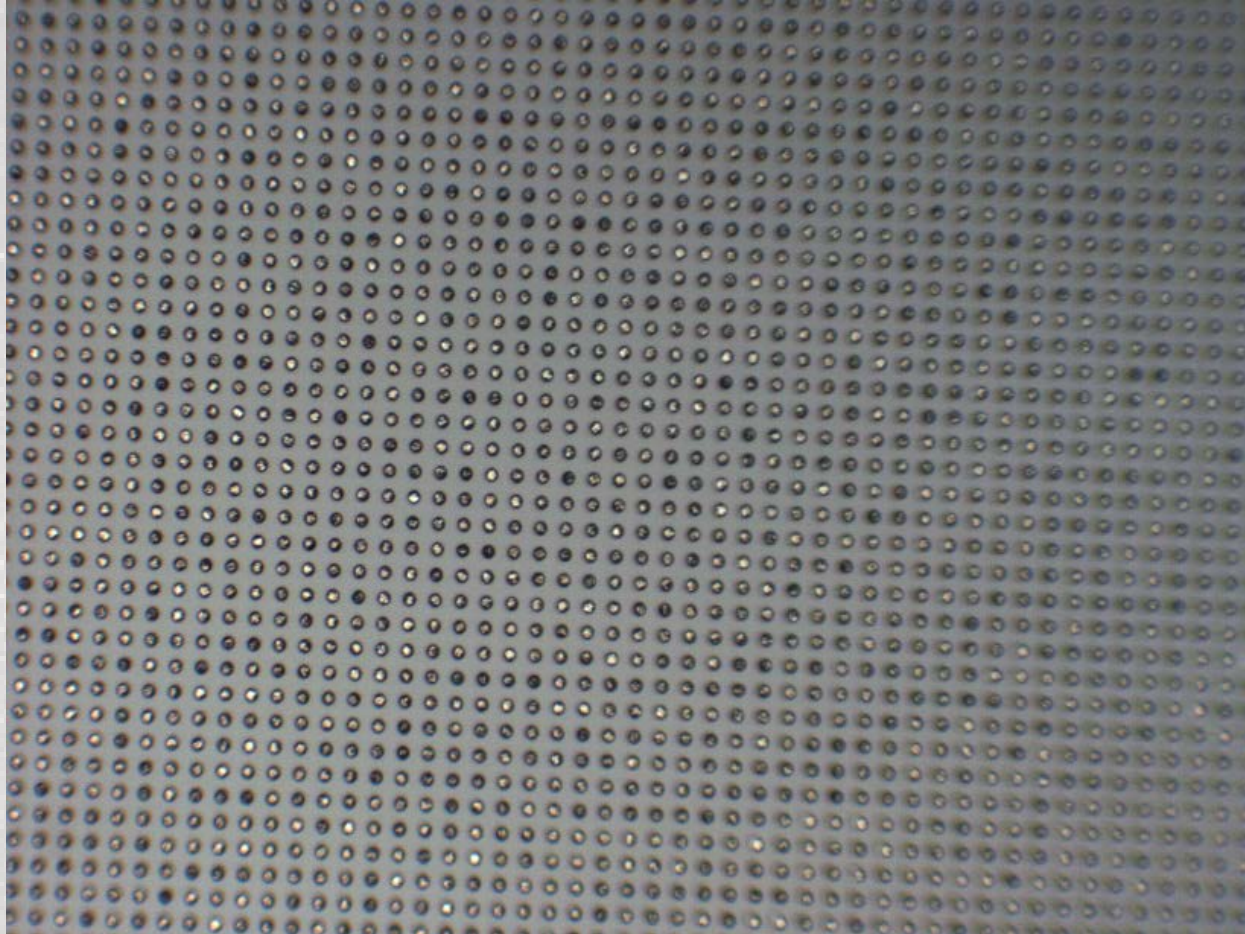
# Indium Bump Damage



Damage due to rolling of metal as it was removed and rubbed the tops off the bumps



# Indium Liftoff High Flow



Good cleaning but slight rubbing during removal creates shine on the tops of the bumps

# Undamaged Indium Bumps



Clean Liftoff achieved at 1.5 hours with gentle liftoff followed by aggressive flow for final cleaning.



# Conclusion



- Indium bumps are very fragile and require gentle liftoff
- Long soaks and gentle strip forces are required to avoid smearing of bump formations during liftoff
- After liftoff is accomplished, final cleaning is performed
- Results on single wafer spray tools destroyed the indium bumps caused by aggressive striping
- The FluidJet is uniquely capable at producing a relatively fast liftoff of 25 wafer cassettes with no damage to features
- Automated liftoff operation with the Fluidjet provides dramatic productivity improvements compared to other methods

## Thank you for your attention