DEVICE TECHNOLOGY & PACKAGING

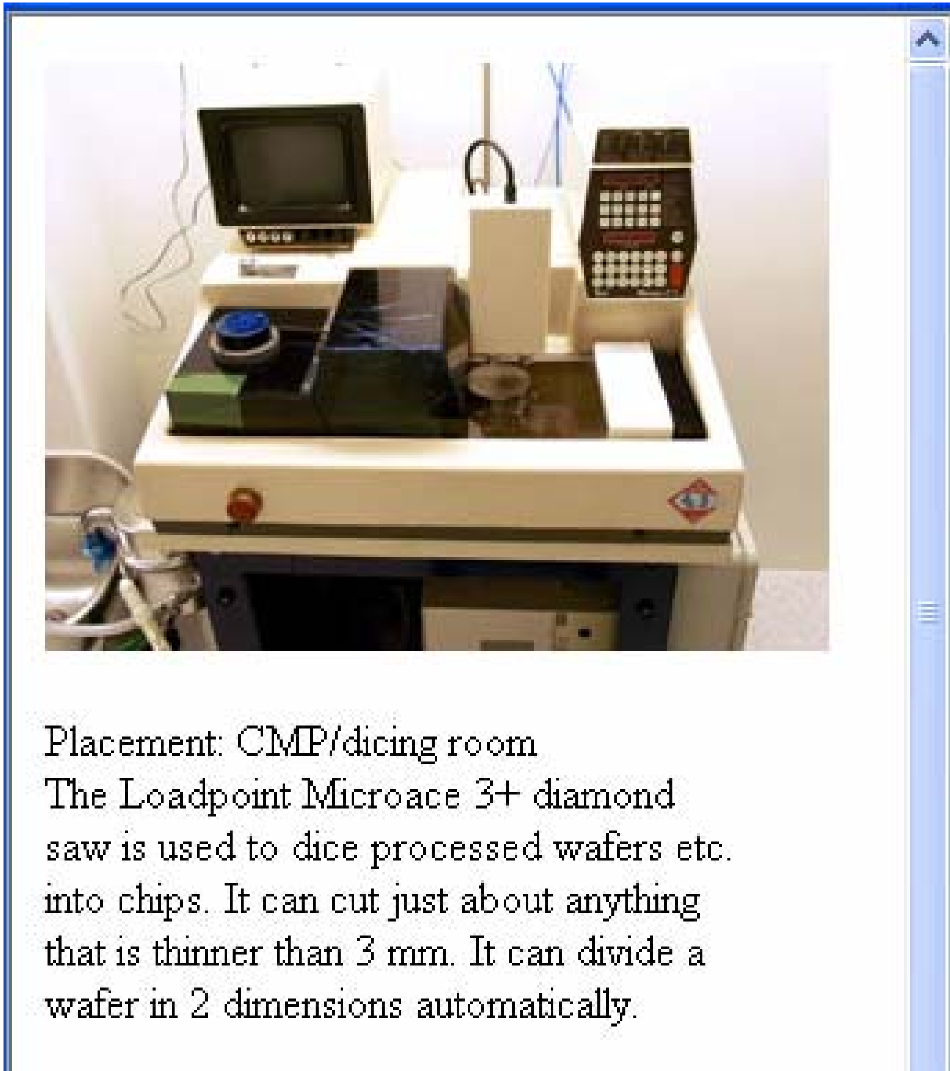
Göran Alestig

- MOS devices
- Silicon Bipolar technology
- Design and layout considerations
- GaAs and other III-V devices
- Packaging
- Reliability

Manufacturing steps related to packaging:

- Testing - On wafer before dicing
  - More complete test after packaging
- Wafer thinning
- Die separation – Scribe or saw
- Die attachment – Epoxy or eutectic
- Wire bonding - Ultrasonic or thermal
  - Ball bonding or wedge bonding
- Flip-chip and solder bump technology

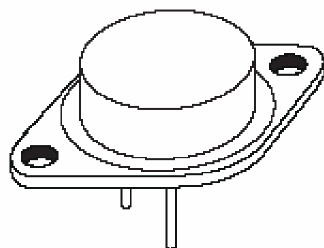
Figure 1. Example of an IC Tester (Left) and Three (3) Examples of Test Handlers (Right)



MC2

252MJ
E13005
518
3 2

TRANSISTOR OUTLINE PACKAGE

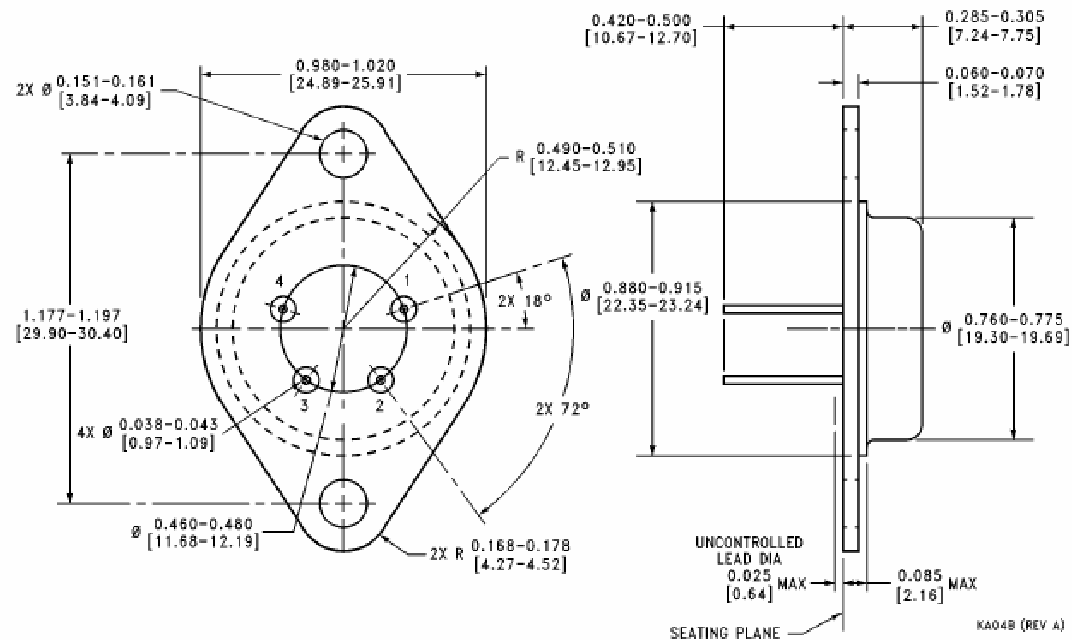


TO-3

National Semiconductor

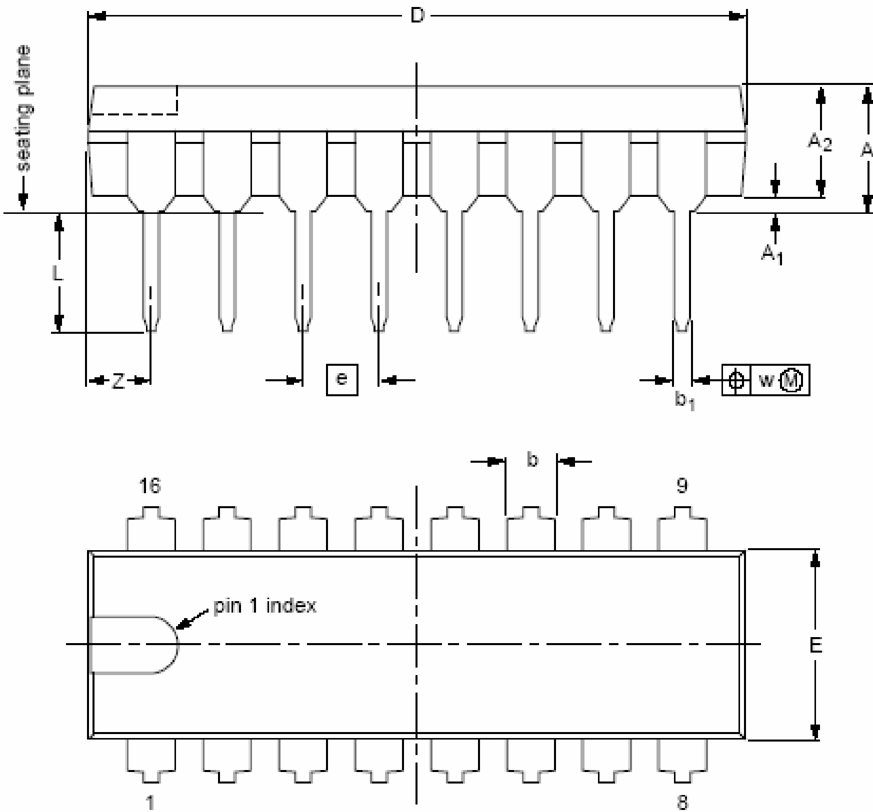
June 1993

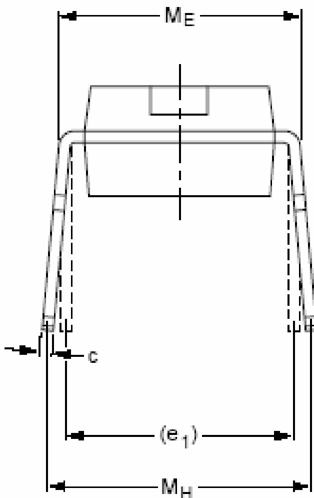
4 Lead TO-3 Metal Can Package, Low Profile
NS Package Number KA04B

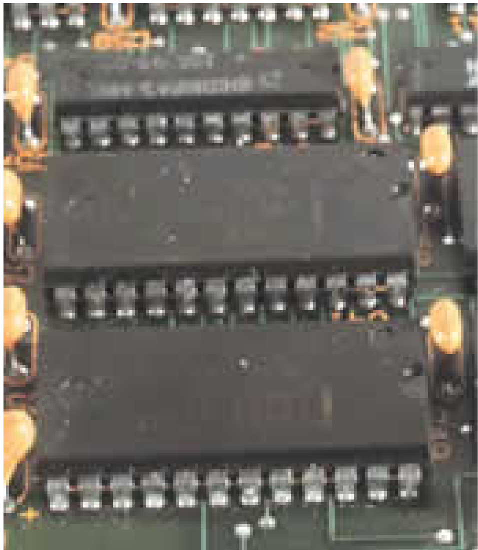


All dimensions are in inches (millimeters)

MC2

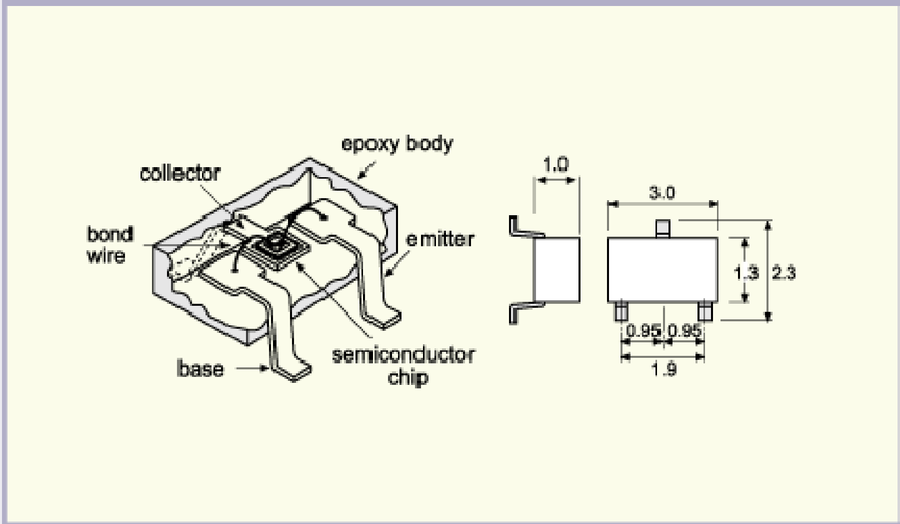






MC2

FKA195



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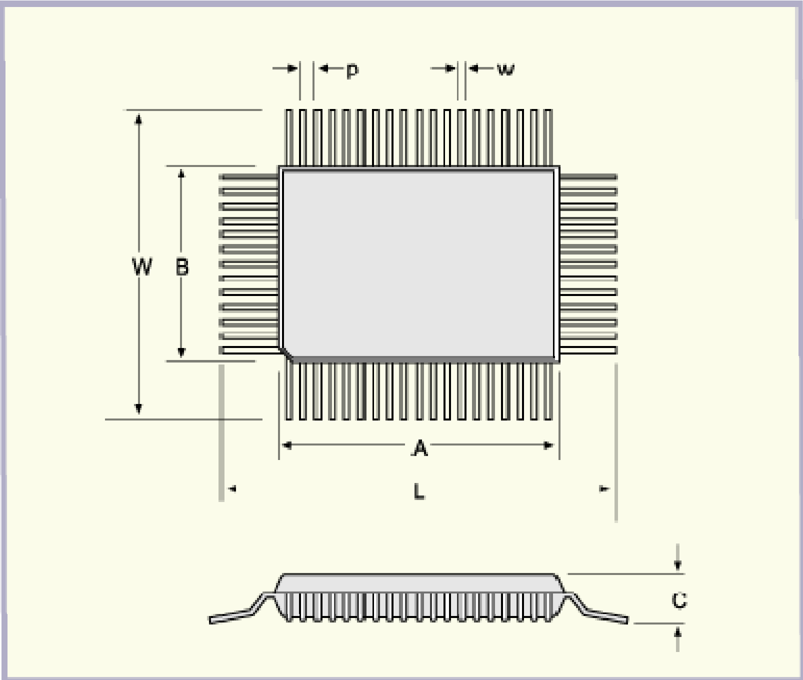

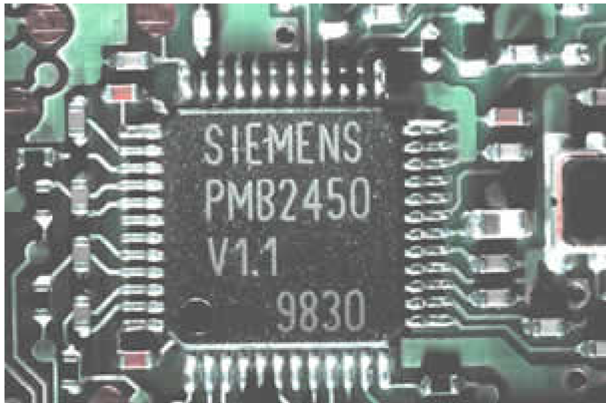

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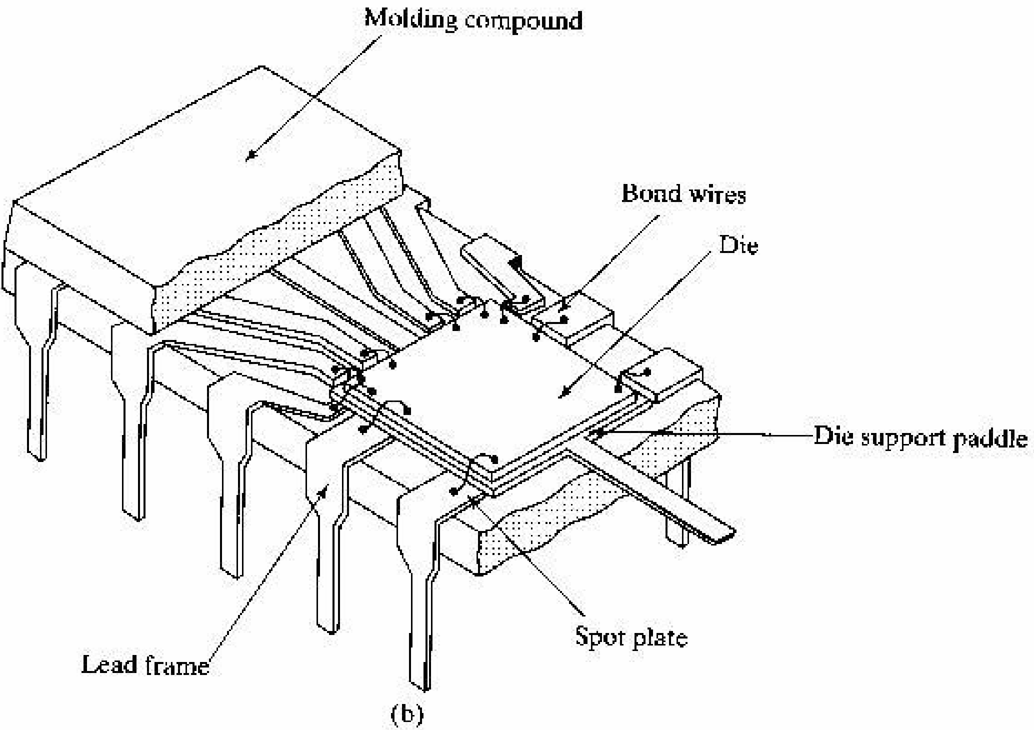
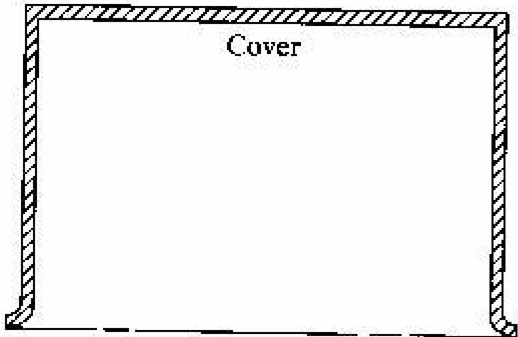
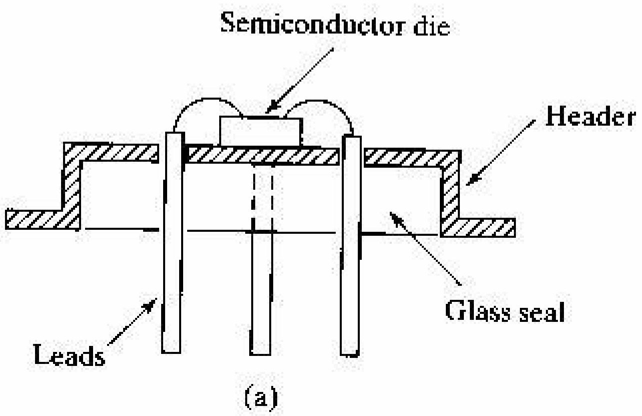
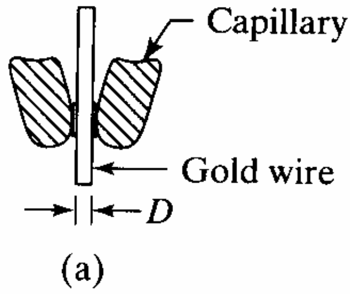


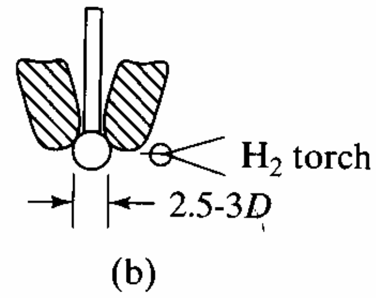
(b)

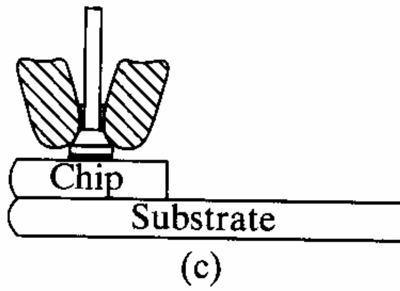


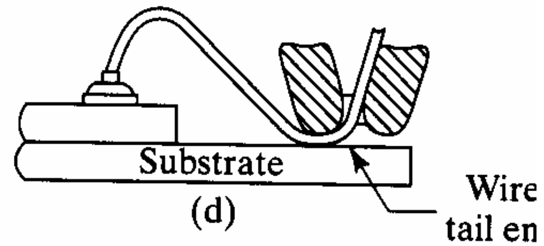


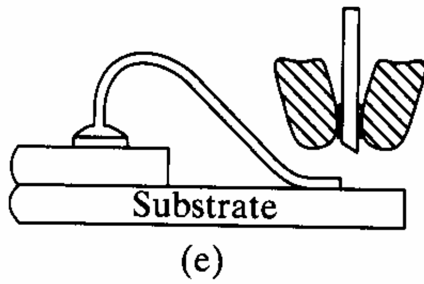
(a)

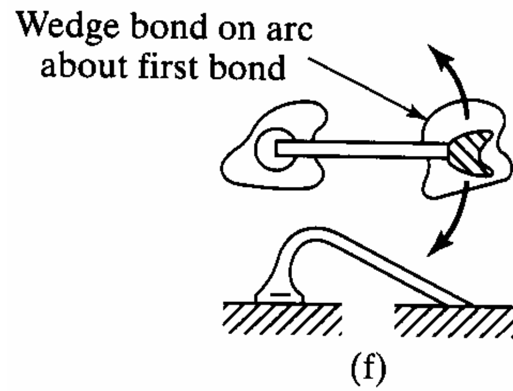




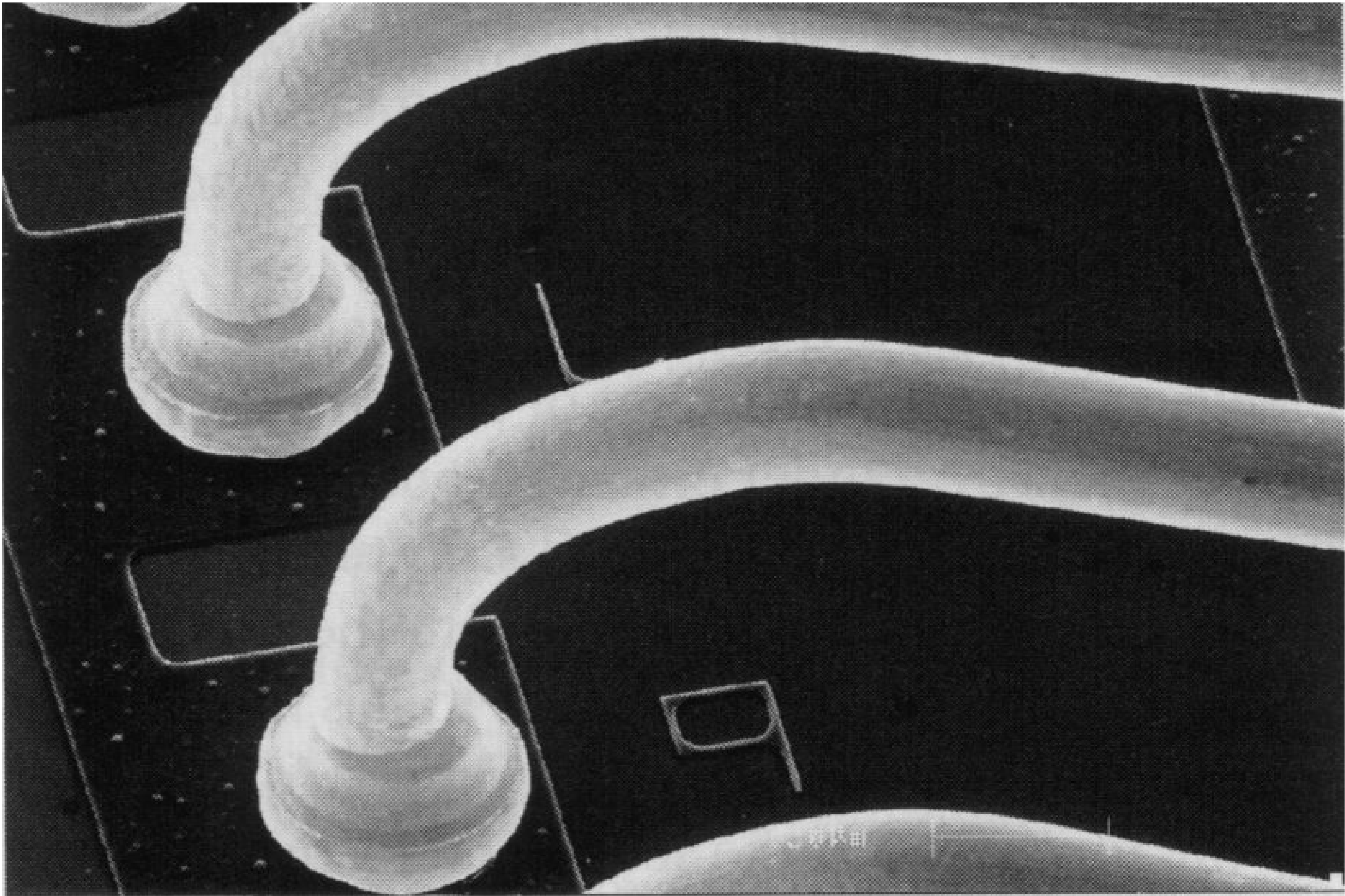


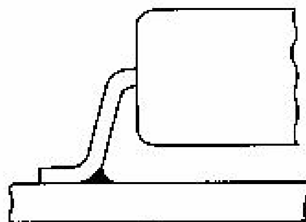




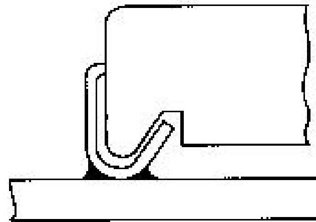


MC2



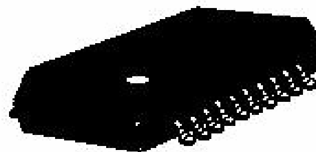


(a)

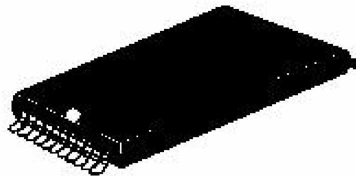


(b)

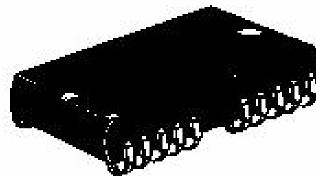
(c)
Small outline transistor (SOT)



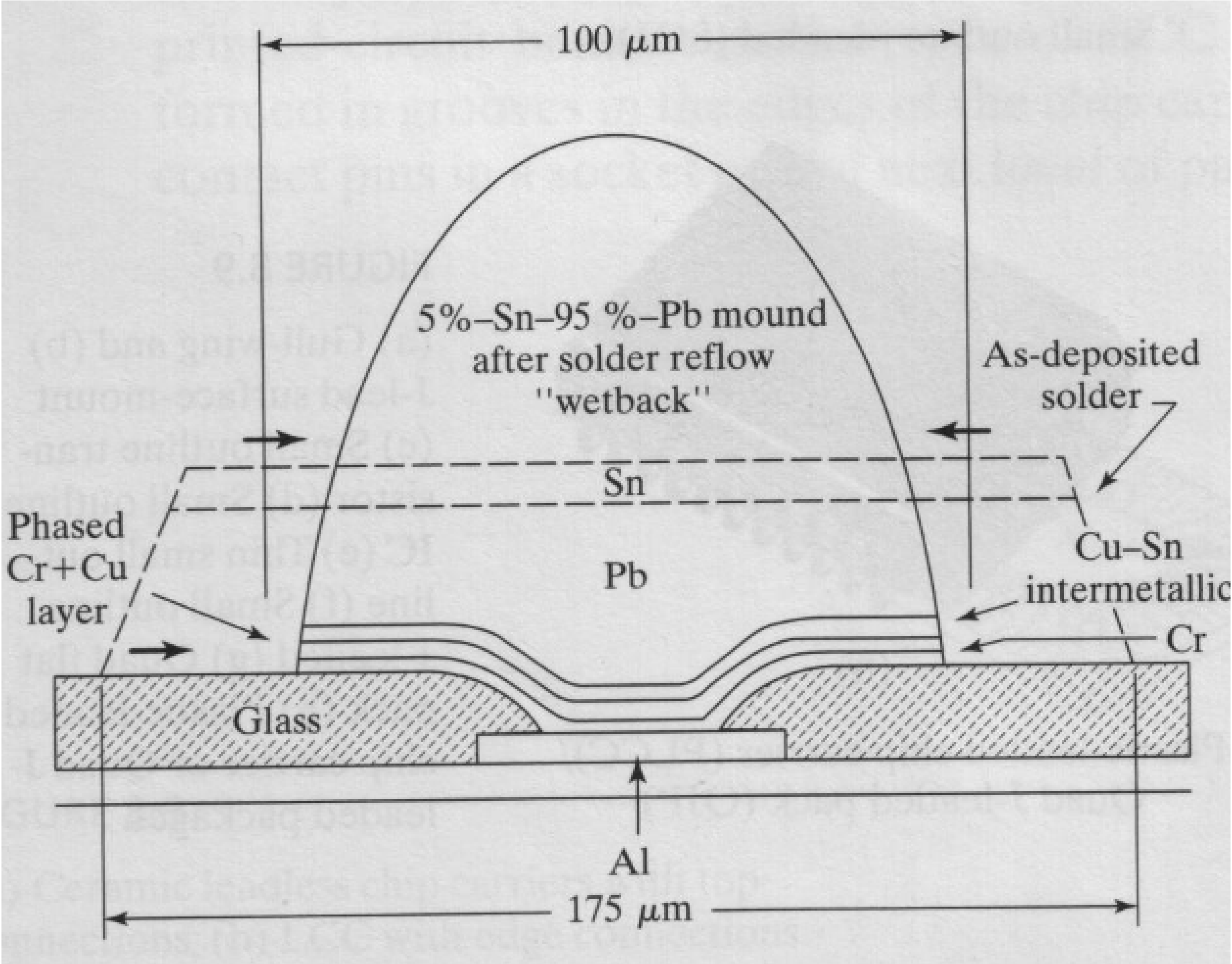
(d)
Small outline integrated circuit (SOIC)



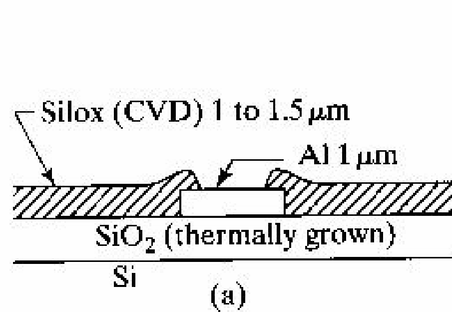
(e)
Thin small outline package (TSOP)

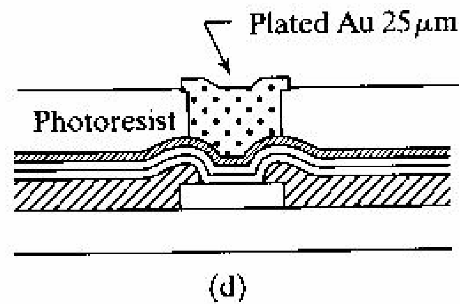


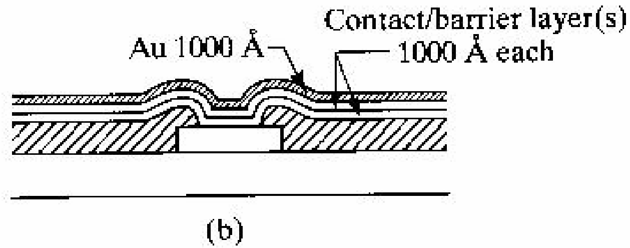
(f)
Small outline j-leaded (SOJ)

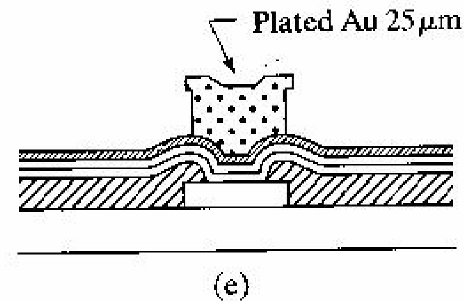


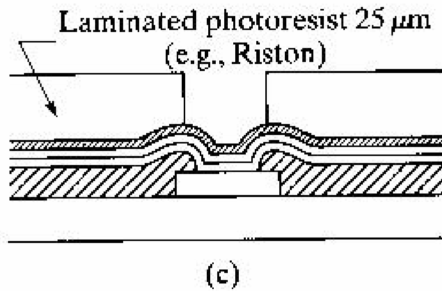
MC2

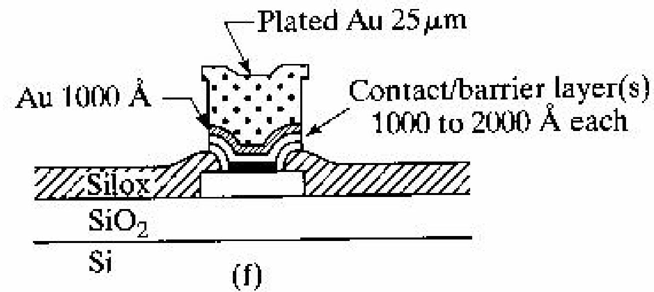

Silox (CVD) 1 to 1.5 μm
Al 1 μm
SiO2 (thermally grown)
Si
(a)

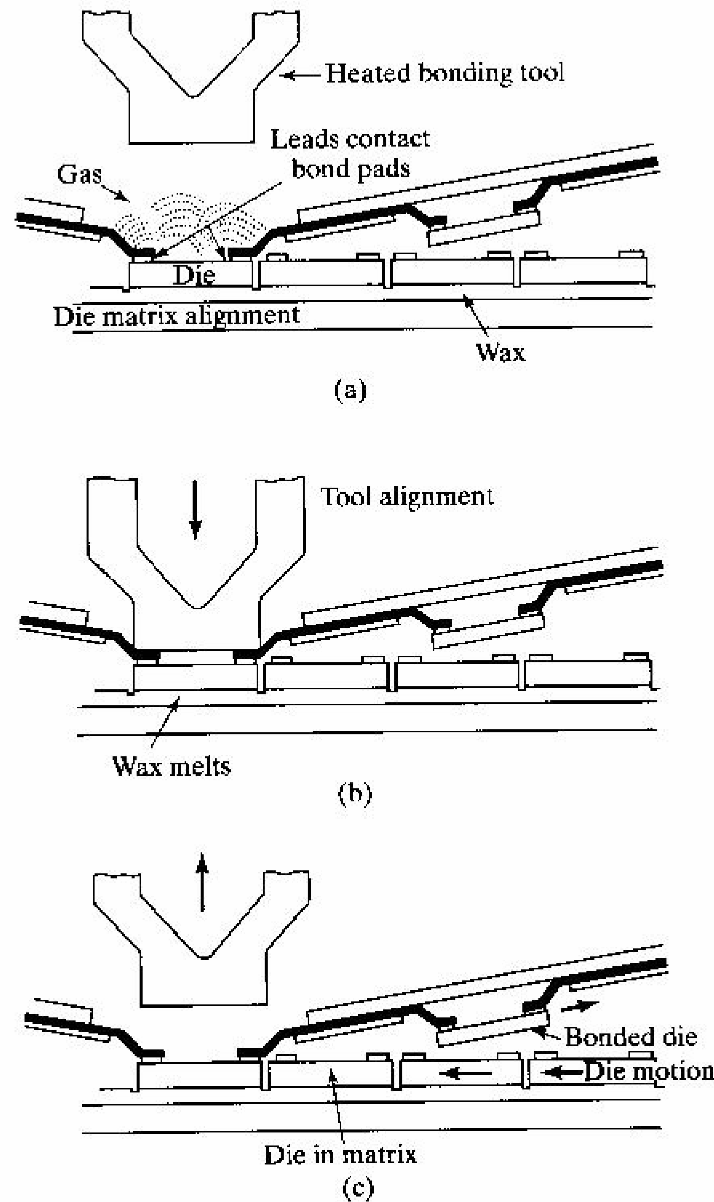

Plated Au 25 μm
Photoresist
(d)


Contact/barrier layer(s)
Au 1000 Å
1000 Å each
(b)


Plated Au 25 μm
(e)


Laminated photoresist 25 μm
(e.g., Riston)
(c)


Plated Au 25 μm
Au 1000 Å
Contact/barrier layer(s)
1000 to 2000 Å each
Silox
SiO2
Si
(f)



TAB = Tape Automated Bonding

MC2

DEVICE TECHNOLOGY & PACKAGING

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- MOS devices
- Silicon Bipolar technology
- Design and layout considerations
- GaAs and other III-V devices
- Packaging
- Reliability

Reliability

- Needs to be ”designed in”, cannot be added afterwards
- Need to pass tests for:

  - Current density

  - Voltage stress (dielectric breakdown, hot electrons, …)

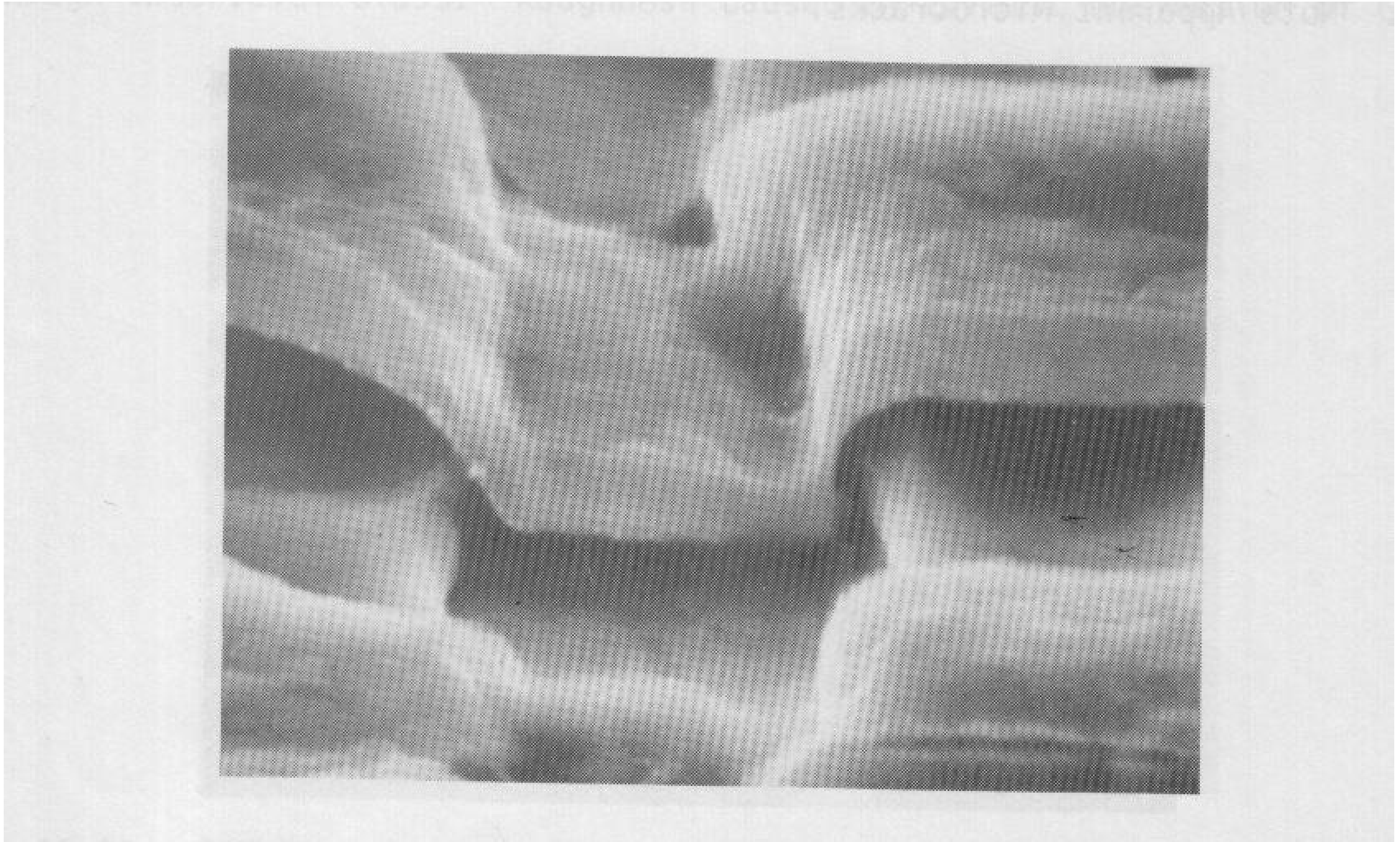
  - Step coverage of metal lines

  - Hot/cold temp stress

  - Passivation integrity

  - ESD (electro-static discharge)

  - etc, etc, …..



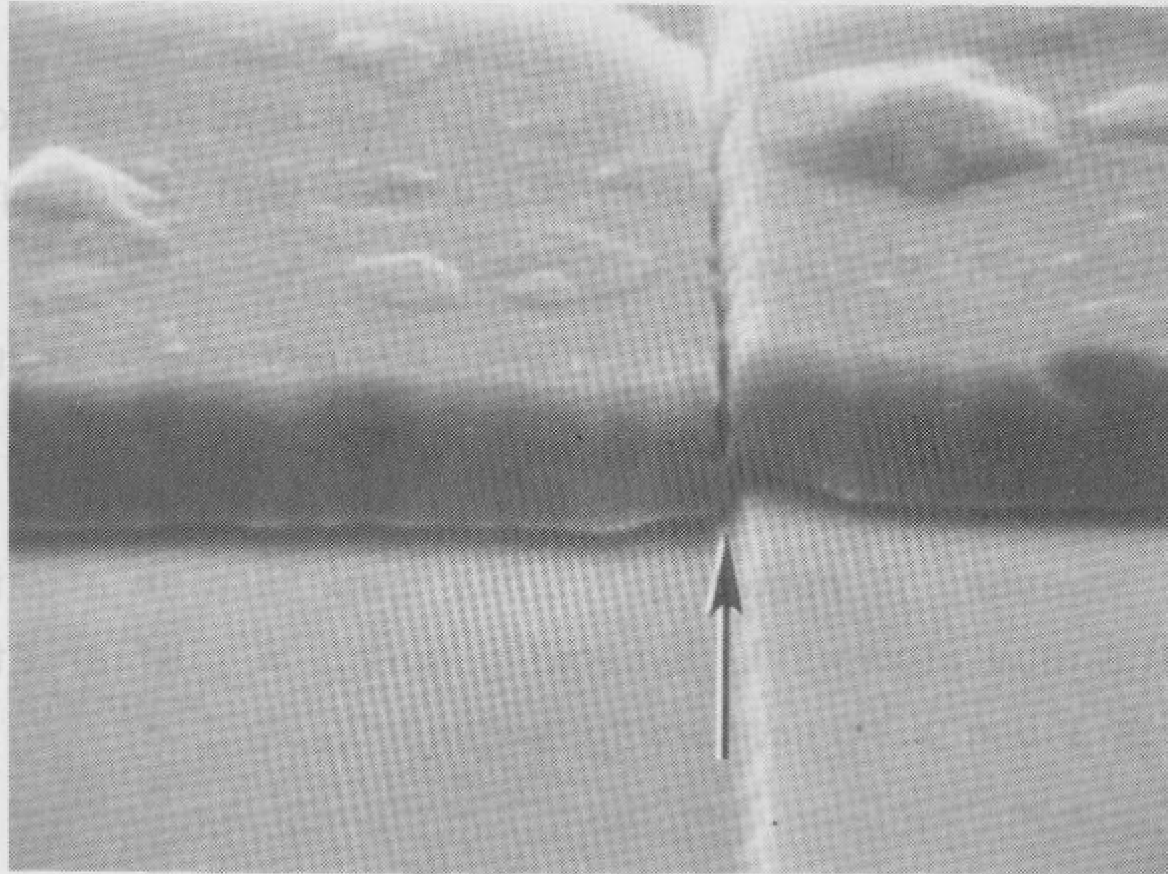
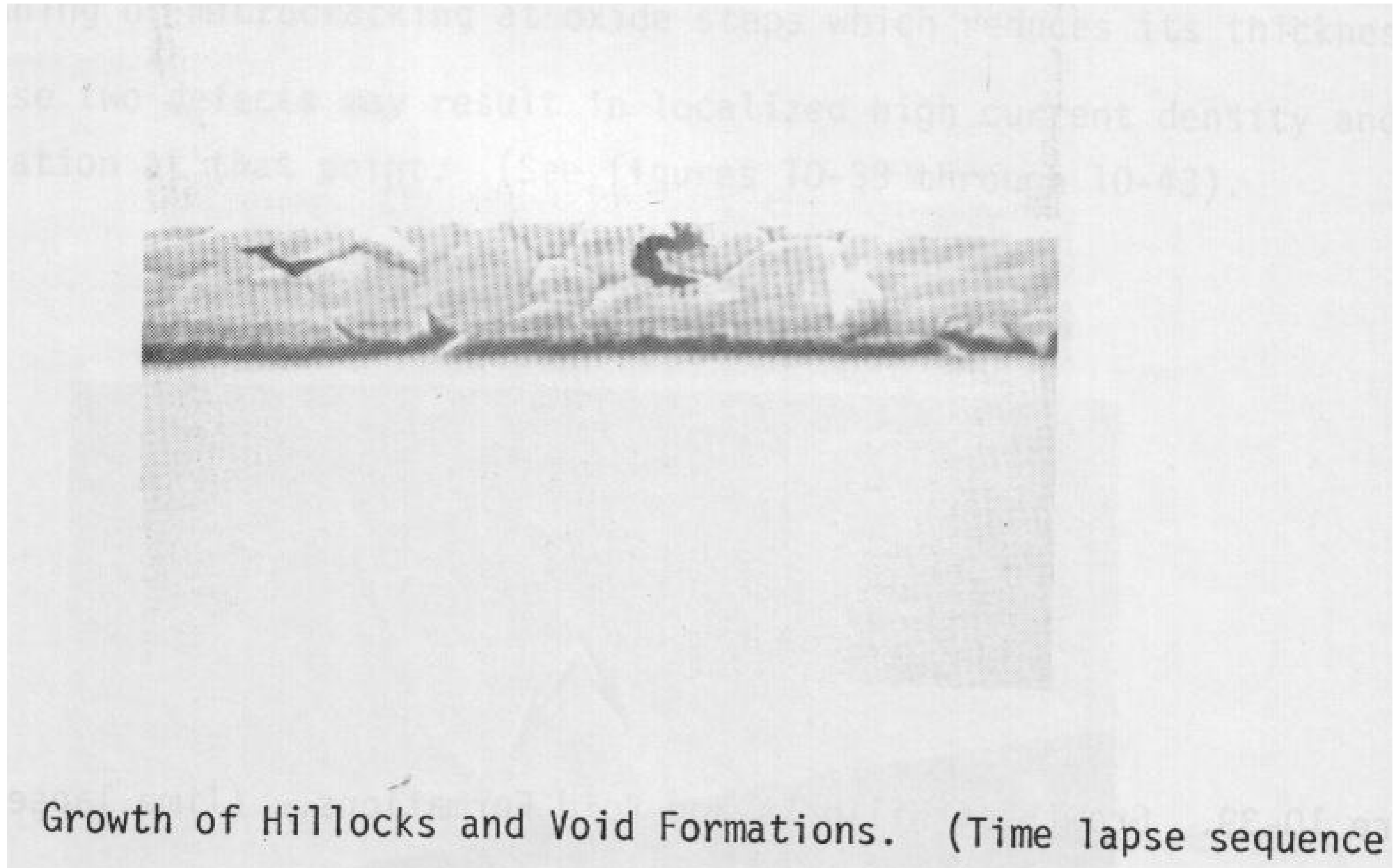
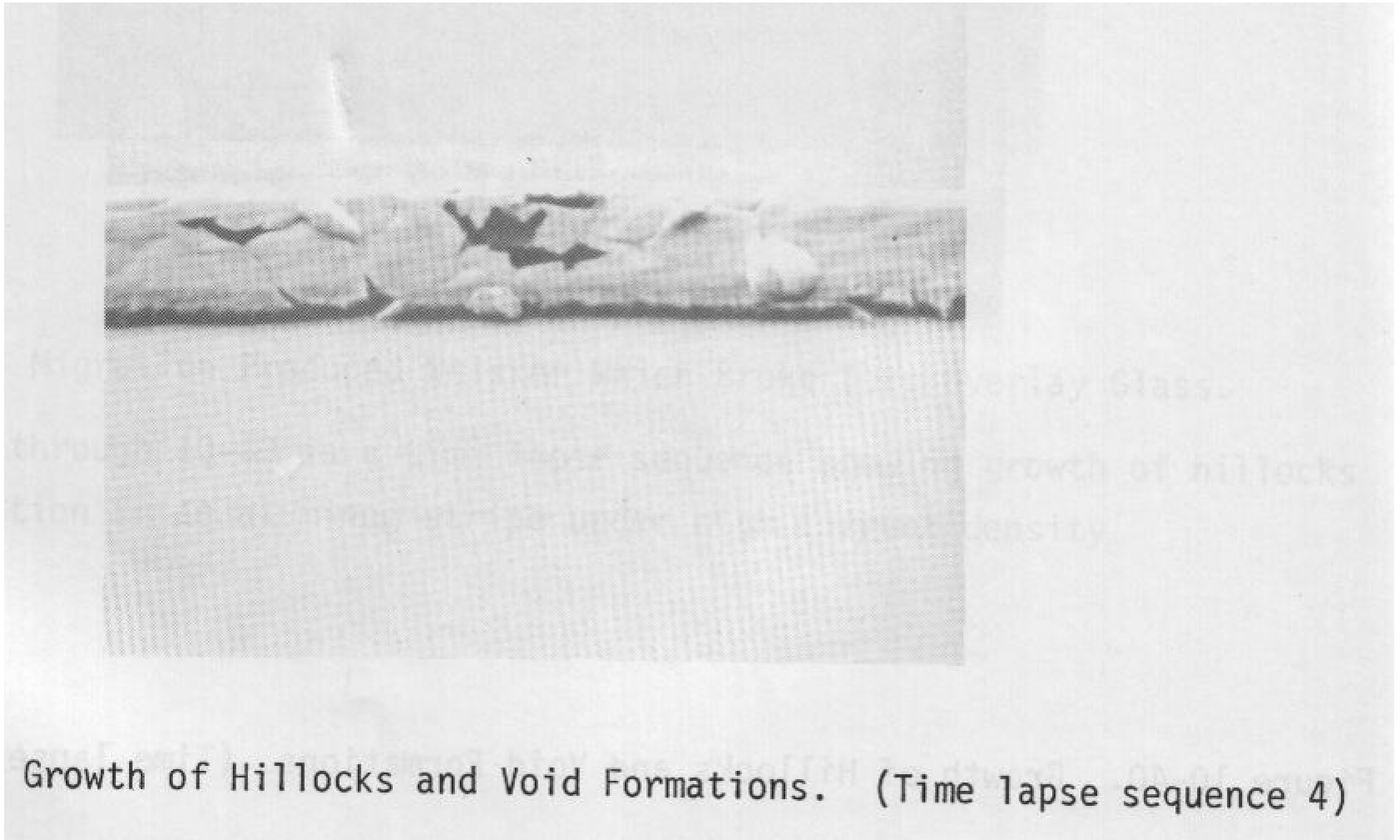


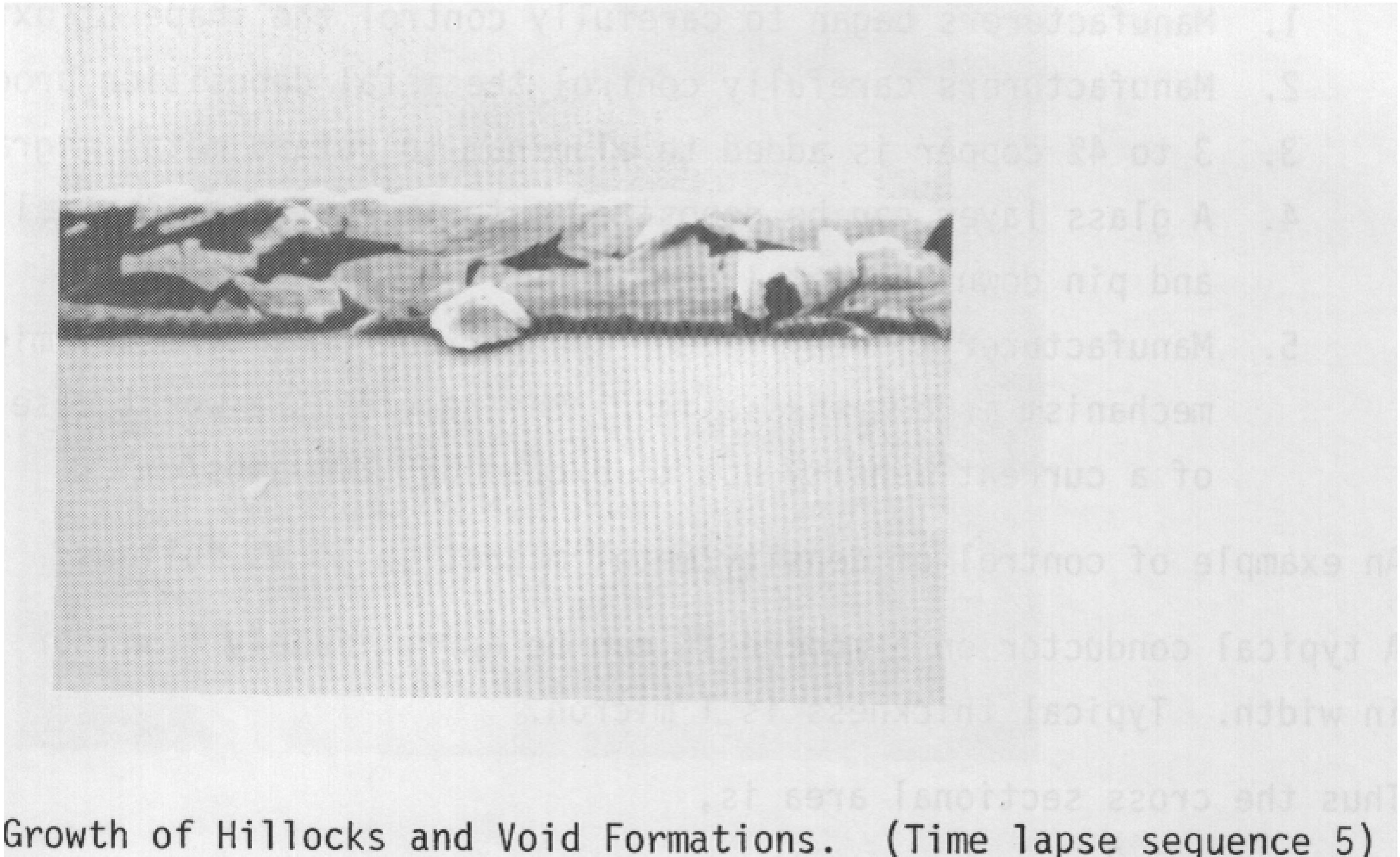
Figure 10-33. Excellent Example of Microcrack Propagation up Thru a Very Thick Metal Layer. Metal is 4 to 5 times as Thick as the Step is High.



Growth of Hillocks and Void Formations. (Time lapse sequence



Growth of Hillocks and Void Formations. (Time lapse sequence 4)



Growth of Hillocks and Void Formations. (Time lapse sequence 5)