# Fine Pitch Micro Probe Tips using Thin Film Amorphous Alloy under the Micromachining Fabrication Technology

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2001/6/6

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# 1.Background

The progress of LSI Manufacturing

## Shrink

Pad pitch is also becoming fine (100um order)

## High frequency

Performance is GHz order

# The necessity of micro probe tips

## Adjusting to fine pad pitch

The width of probe tips will be under 100um.

## High frequency transmission

The length of probe tips will be much less than a quarter of wave length.

# How to fabricate micro probe tips?

1.Under the micromachining fabrication technology

Micro 3D structure can be realized.

2.Using a kind of amorphous alloys as material

Amorphous alloys are strong even in micro scale
(in the shape of thin film, for example )
because of no grain boundary.

# 2.Materials

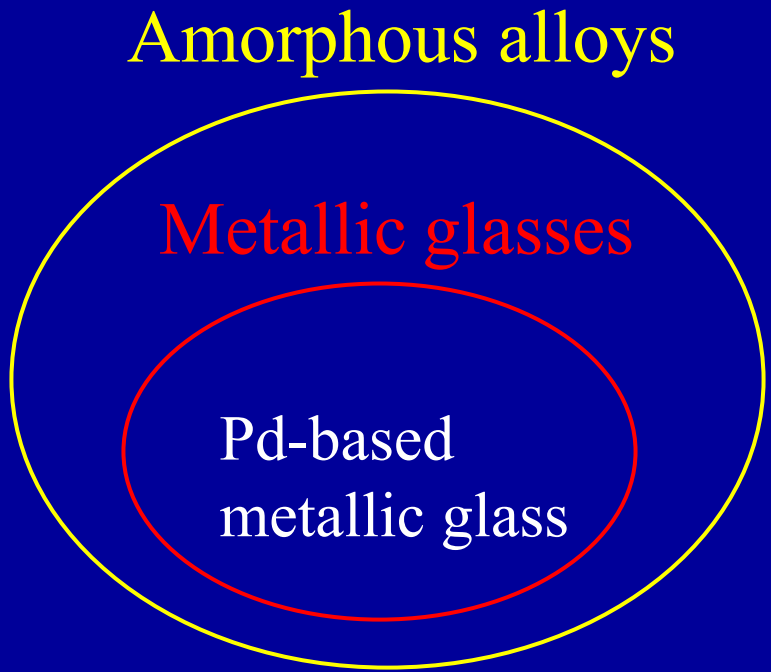
Thin film amorphous alloy

The features of amorphous alloys:

Hardness
Mechanical strength
Small Reactivity to chemicals
No grain boundary
etc…

# Thin film metallic glass(TFMG)

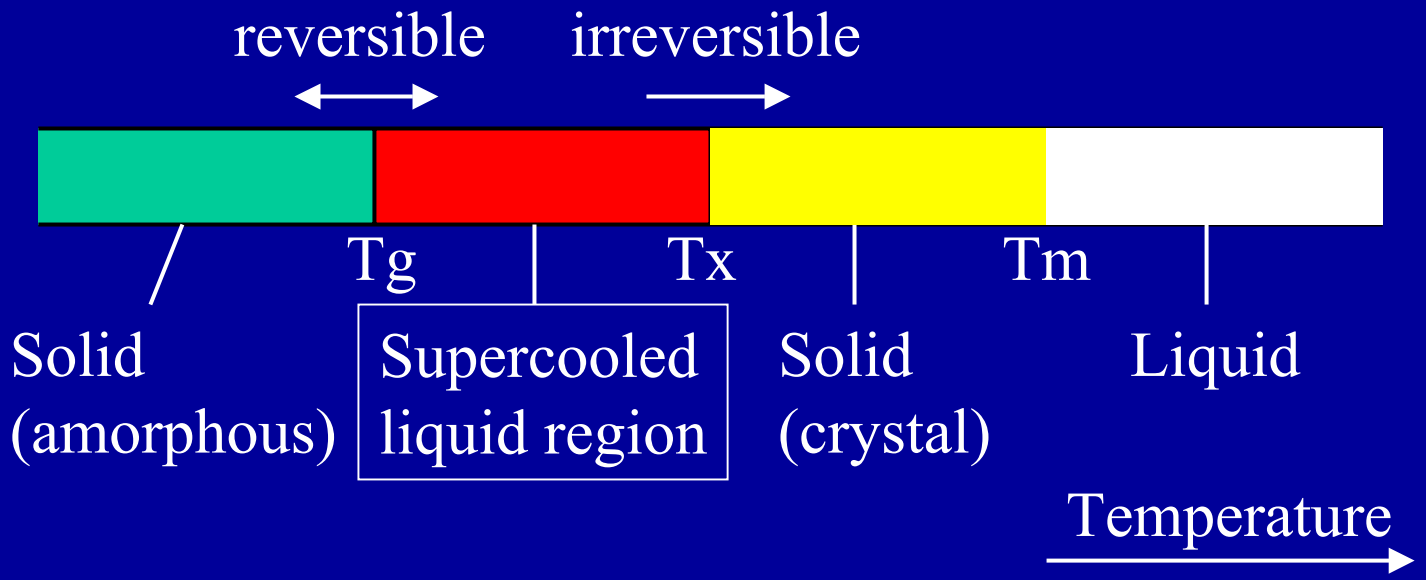
Metallic glass is a kinds of amorphous alloys



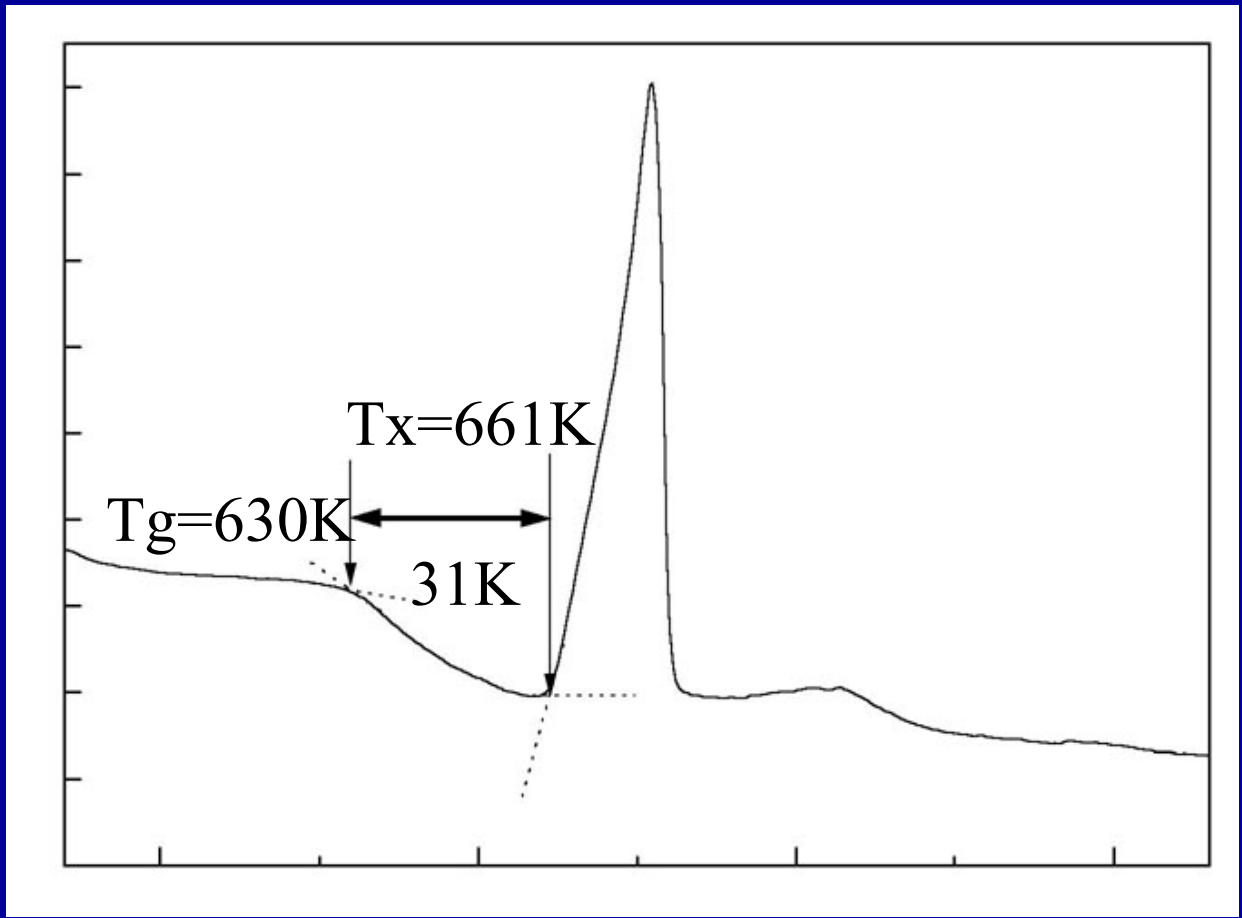
# The features of metallic glasses:

In addition to ones of amorphous alloys…

**Wide supercooled liquid region**



# DSC curve of the Pd-based TFMG:



The preparation of TFMGs

- Deposition:

  DC-magnetron sputtering
  with an alloy target.

- 3D-deformation:

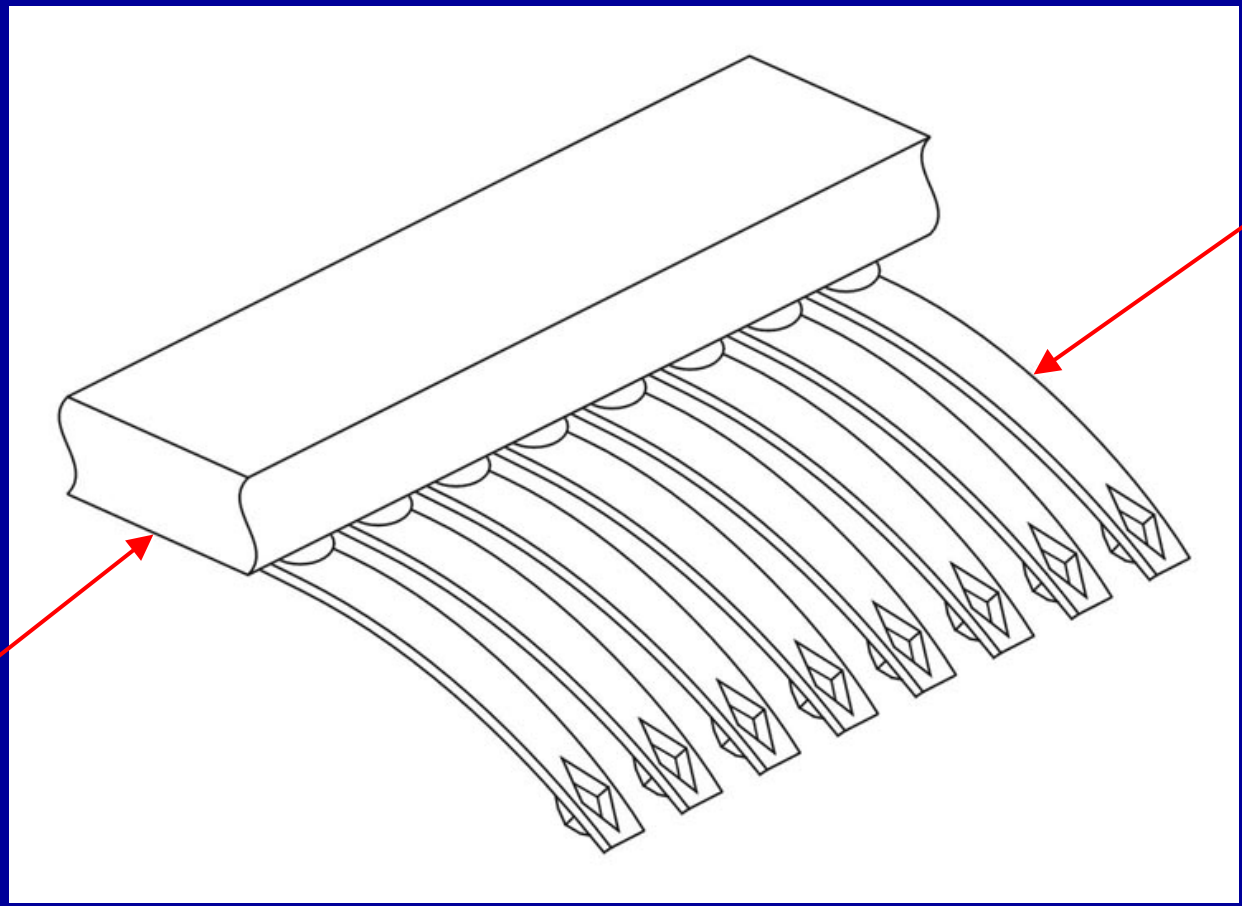
  Heating up to the supercooled
  liquid region and applying force

# 3.Probe Card Structure

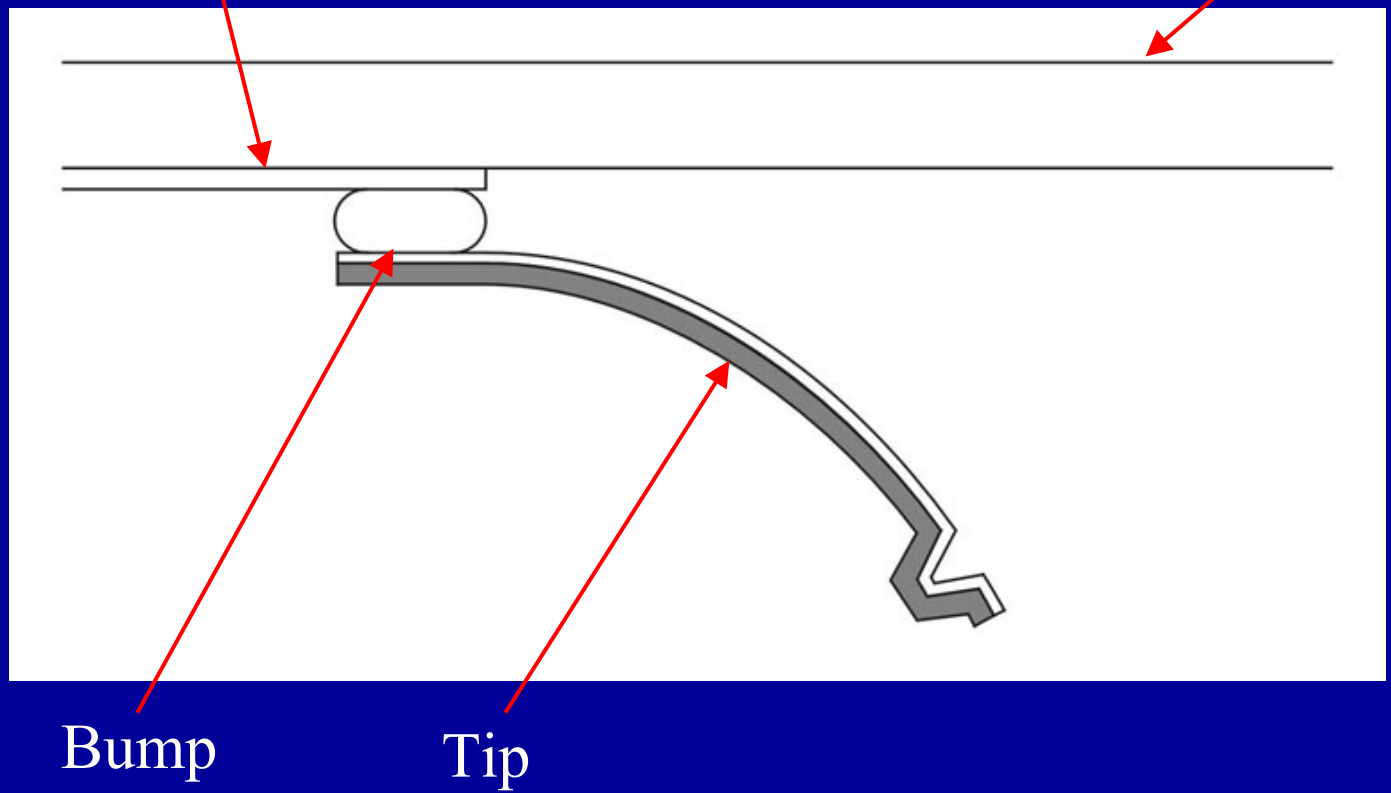
Key Technologies:

- Process under the micromachining fabrication technology on Si substrate
- Pd-based TFMG as material
- Process on Si substrate, and bonding directly on another substrate with transmission lines (e.g. micro-strip lines,coplanar lines)

# A series of Tips



# Cross section of a tip

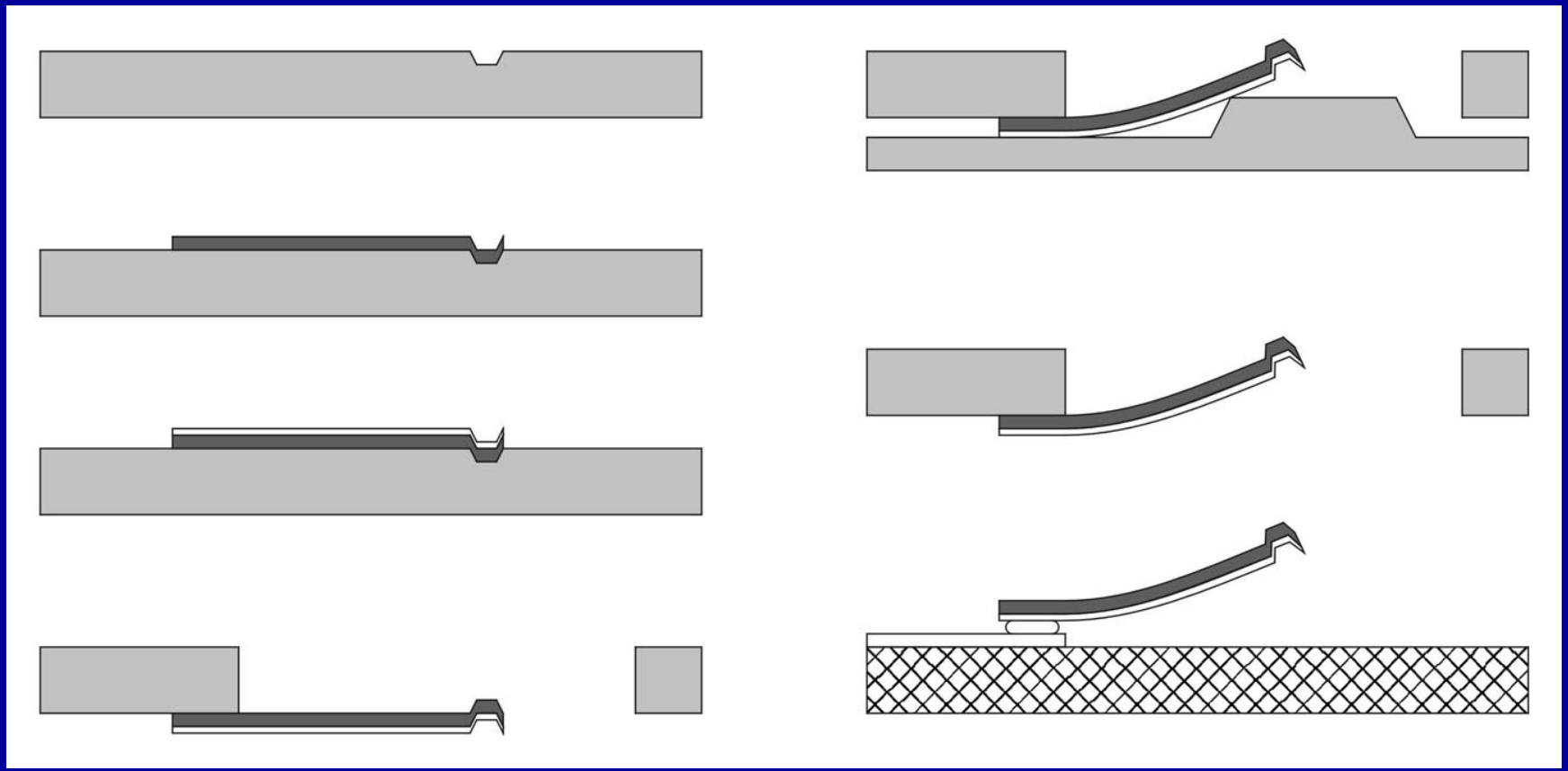


# 4.Fabrication Process

Process flow:

1.Etching micro mesa on Si surface
2.Deposition of cantilever shaped TFMG pattern
3.Au electroplating on the TFMG pattern
4.Backside etching of Si substrate by ICP
5.Plastic deformation of TFMG cantilever
6.Direct bonding on another substrate

# Process Chart



# 5.Results

## Size of Sample Tips

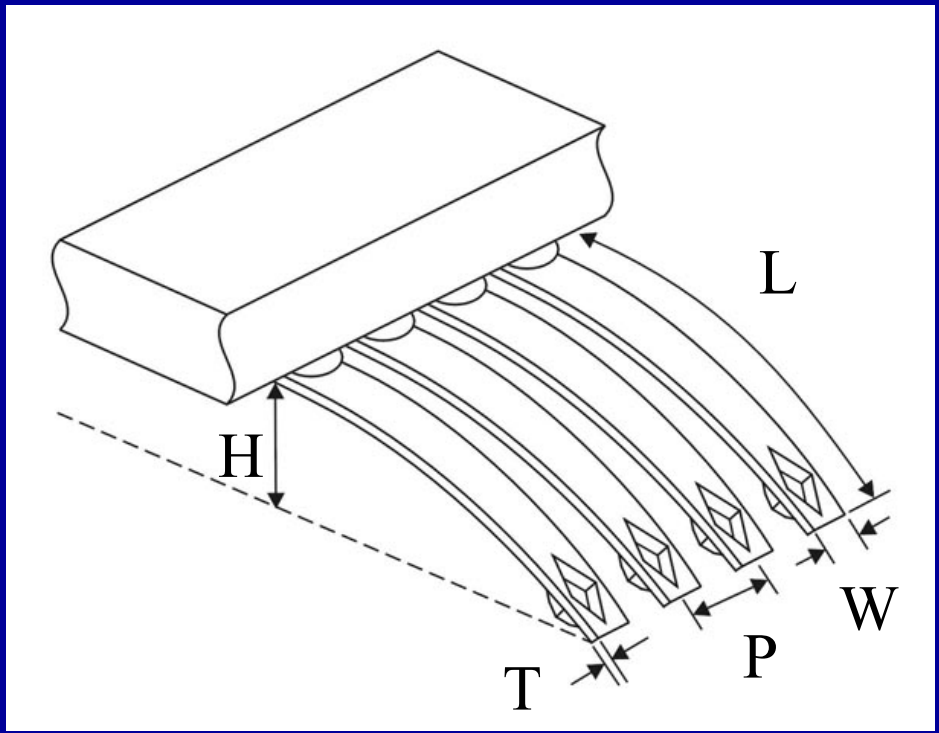
Length: 300um

Width: 60um

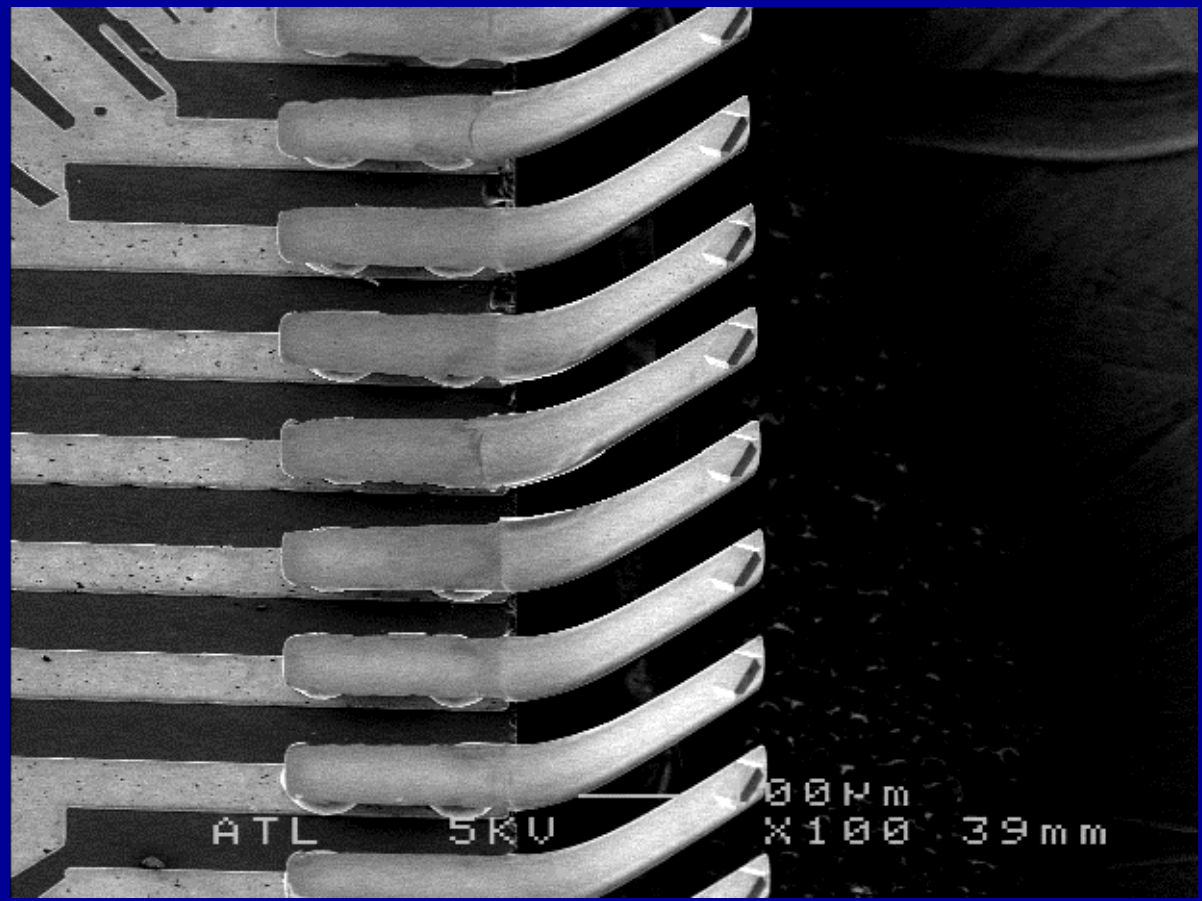
Thickness: 5um

Height: 200um

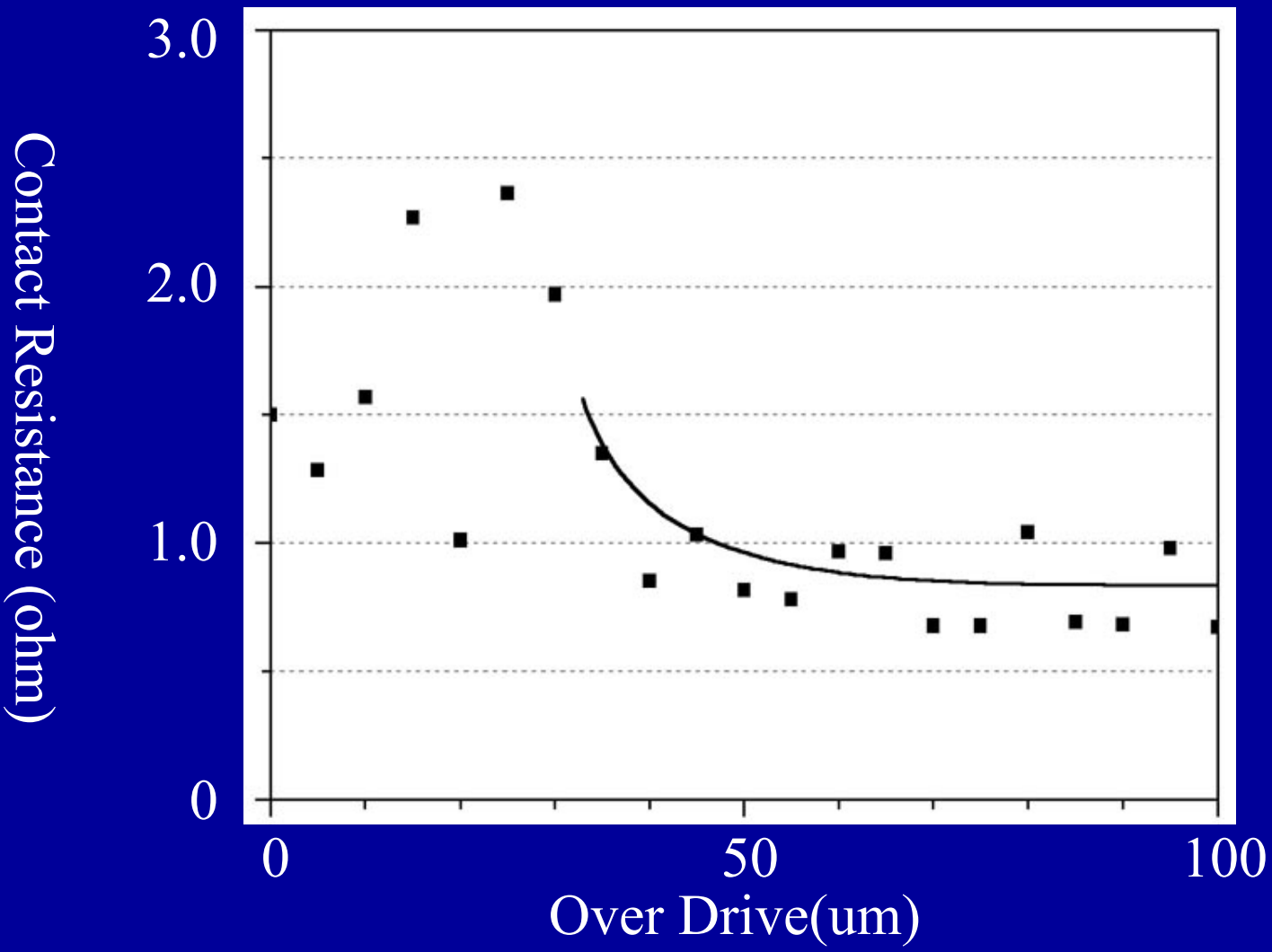
Pitch: 150um



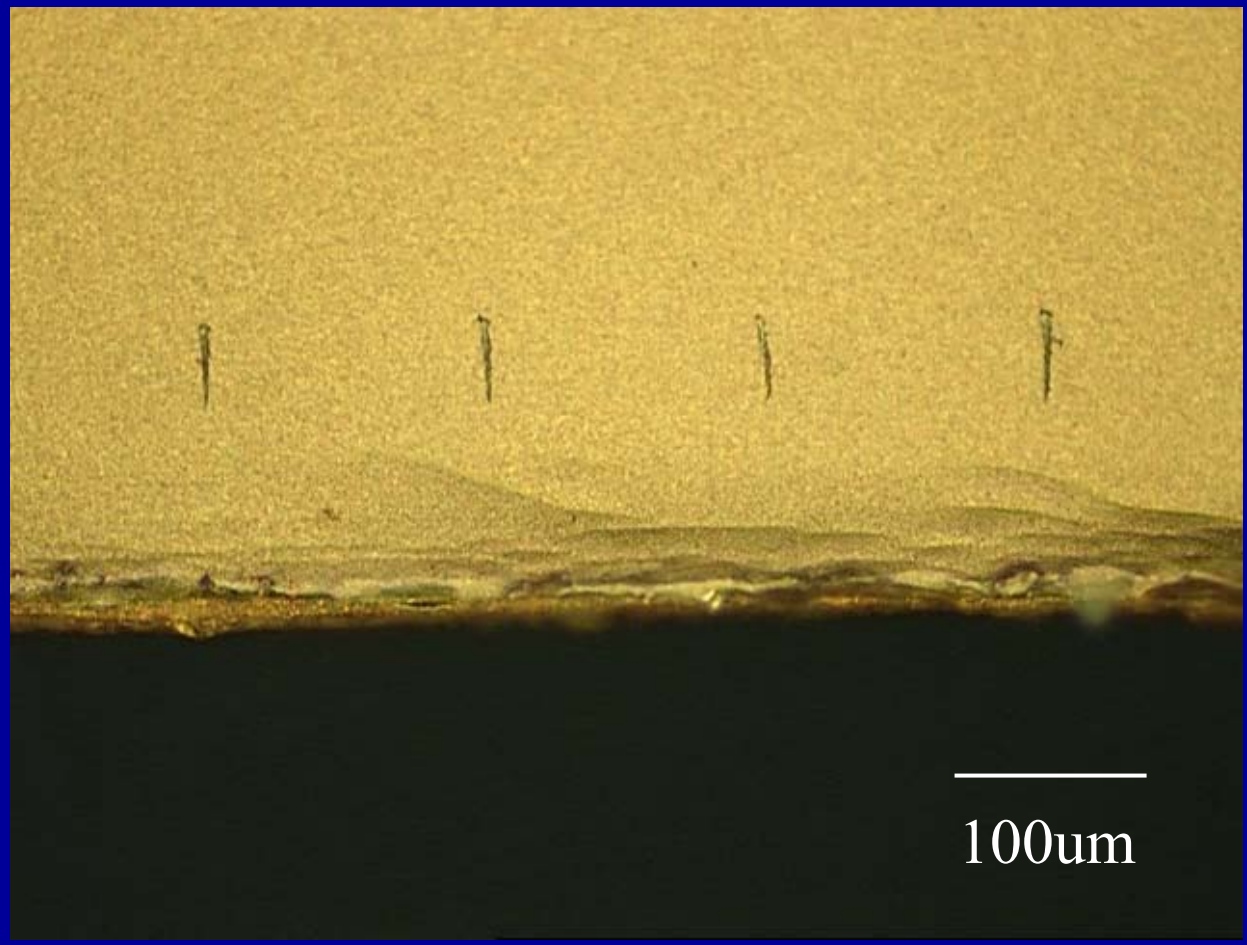
# SEM Image:



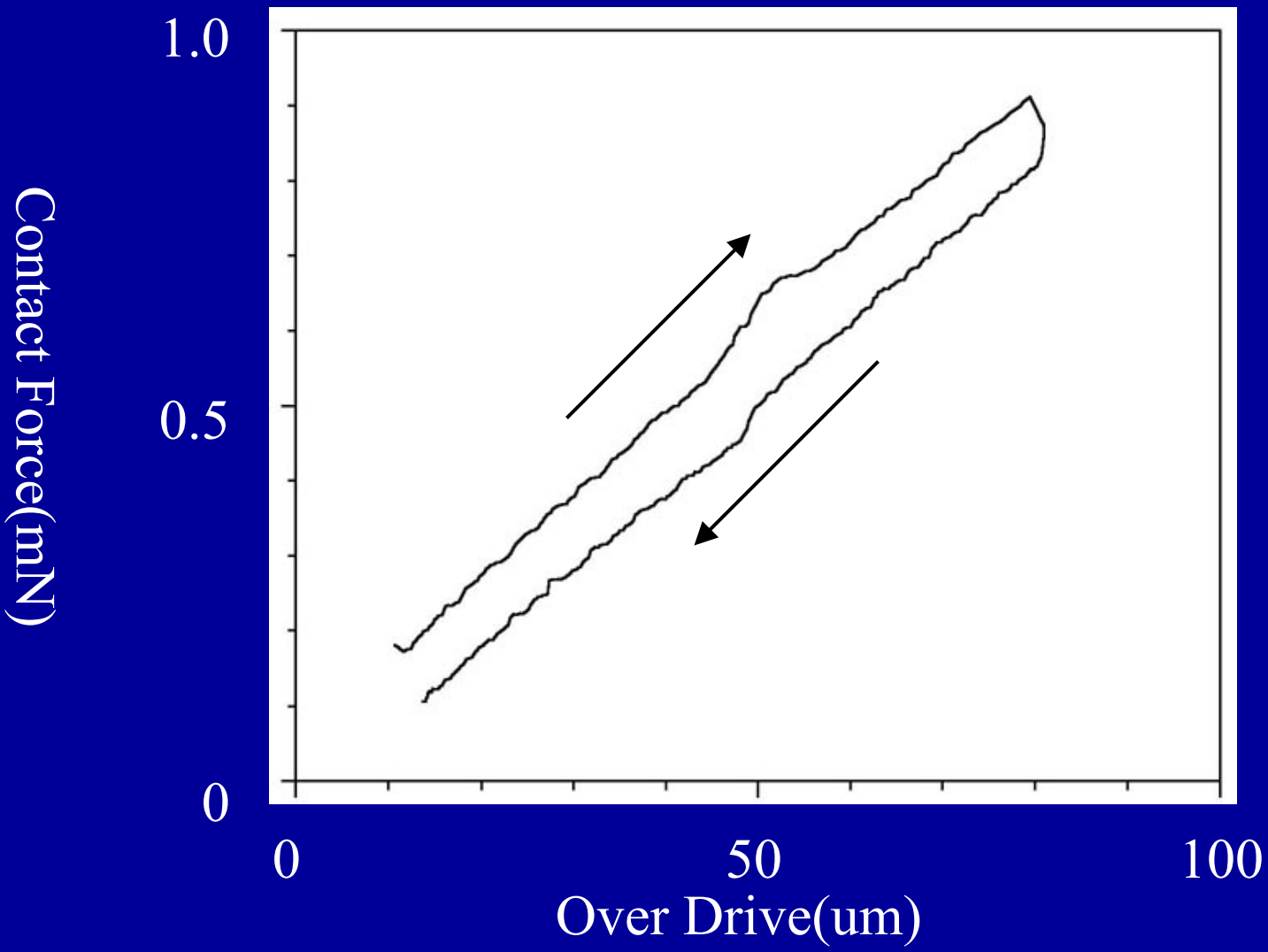
# Contacting with Au electroplating film:



Scrub marks:



# Contact Force:



# 6.Conclusion

Micro probe tips are realized under the micromachining fabrication technology

- Using TFMG as material
- Adjusting to fine pad pitch
- Direct bonding to high frequency structure

# Acknowledgment

A part of this work was supported by NEDO. (NEDO stands for New Energy and Industrial Technology Development Organization)