Industrialisation of

RF – MEMS Filter technology:

Packaging and Outlook

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Content

- customer request for industrialisation
- theory and design
- device overview
- processes on wafer level
- development of packaging design
- processes for packaging
- realised filters
- outlook

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Customers request

Request:

Realisation of a custom specific

RF –MEMS Membrane Filter Design

Technical specification:

down - converter filter at K_a - band

f_0 = 19.8 GHz

Initial bandwidth ~ 0.75 GHz

min. loss at f_0 ~ - 3 dB

etc.

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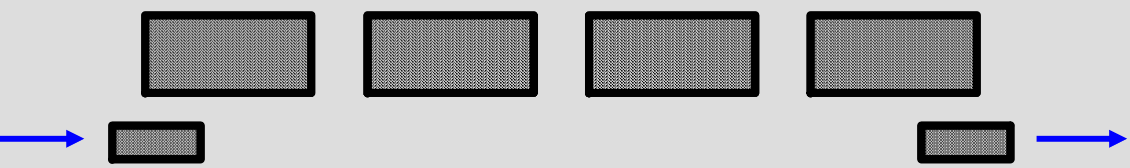
Theory and Design

Please remember on the pervious talk by Dr. Chatras



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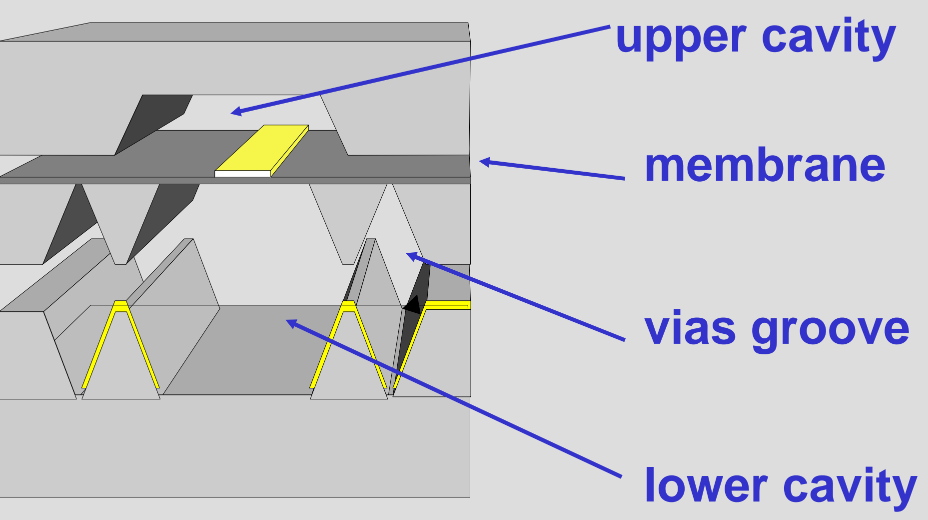
Device overview I

The devices are built up out of 3 stacked wafers forming a resonating cavity:



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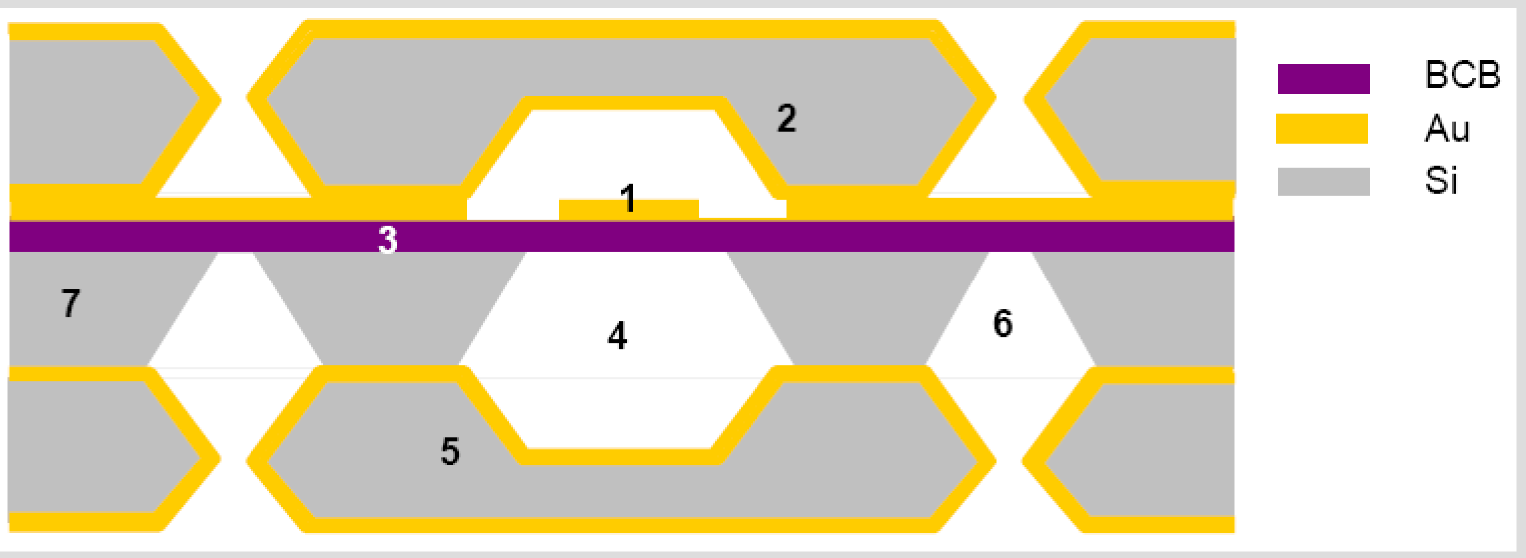
Device overview II



1. *microstrip Line (waveguiding part)*
2. ground metallisation *top wafer*
3. BCB membrane
4. cavity divided by BCB membrane
5. ground metallisation *bottom wafer*
6. electromagnetic shielding
7. high ohmic Si

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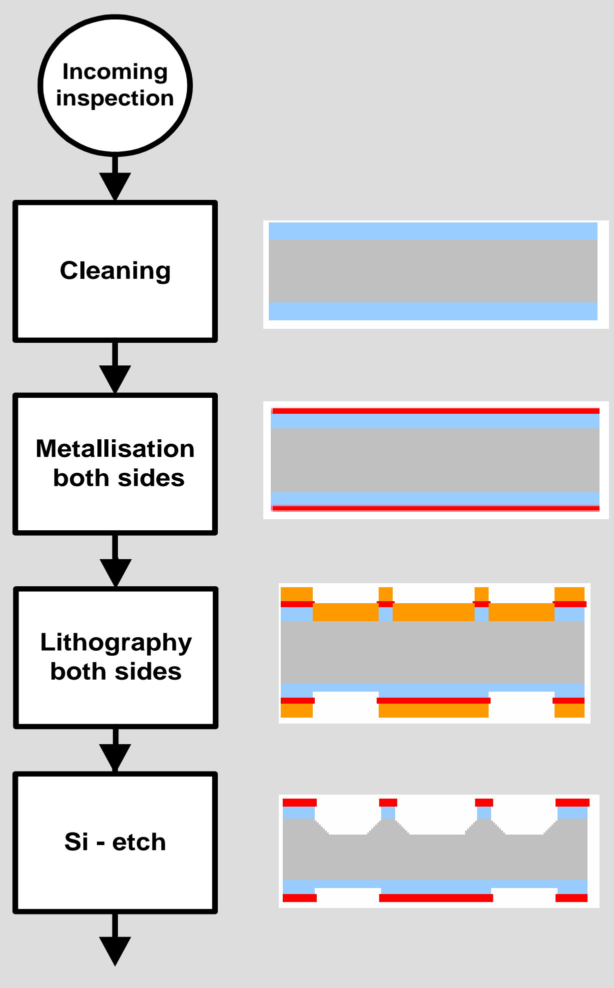
Wafer Processes I



Process follow up for Bottom wafer (I):

- cleaning
- metallisation (both sides)
- lithography (both sides)
- Si - etch

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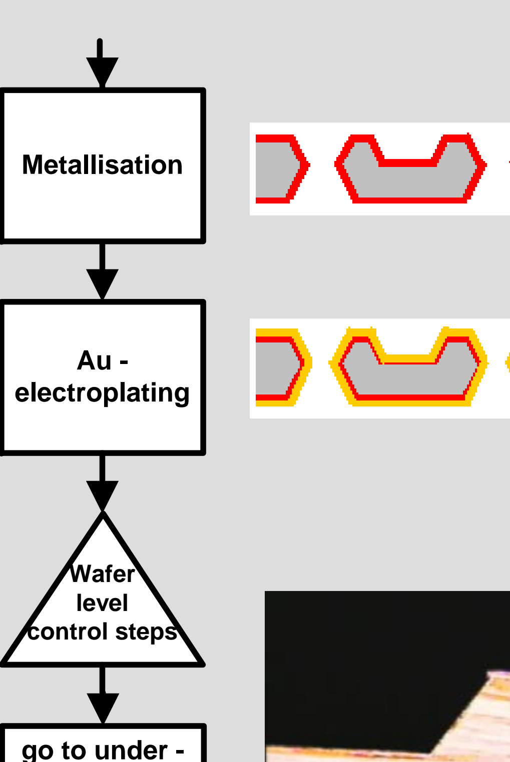
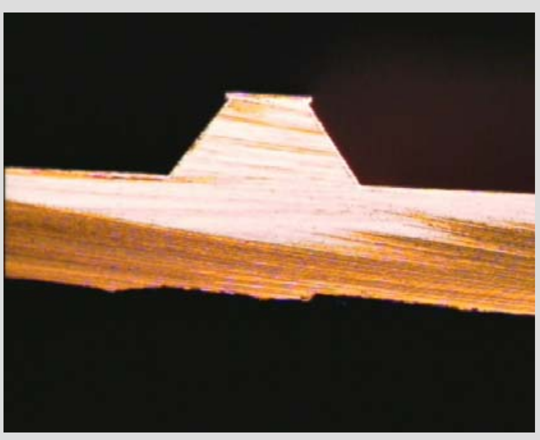
Wafer Processes II

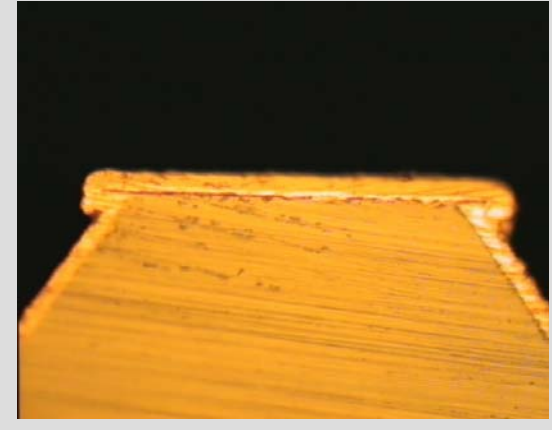


Process follow up for

Bottom wafer (II):

- 2nd metallisation
- electroplating (top 8.5; slope 7, bottom 6.7 µm Au)





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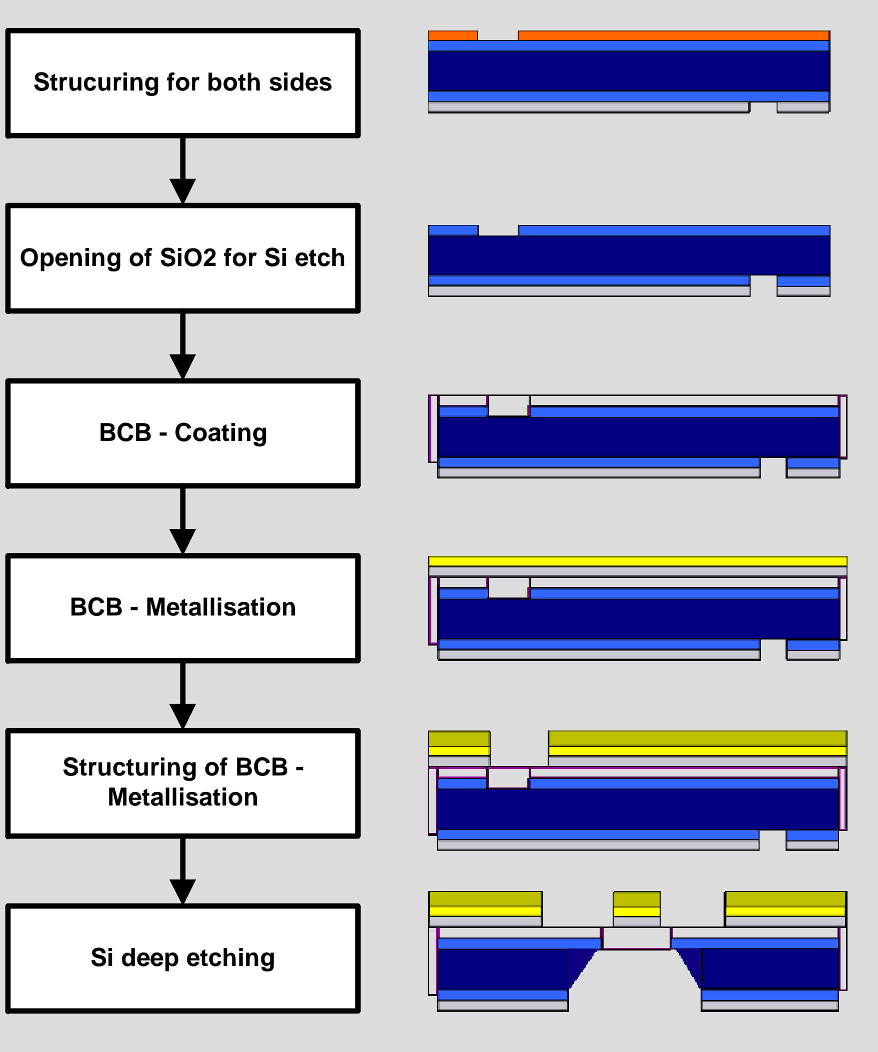
Wafer Processes III



Middle wafer key processes:

- BCB – Processing
- Si – etch simultaneously
- handling of thinned wafers

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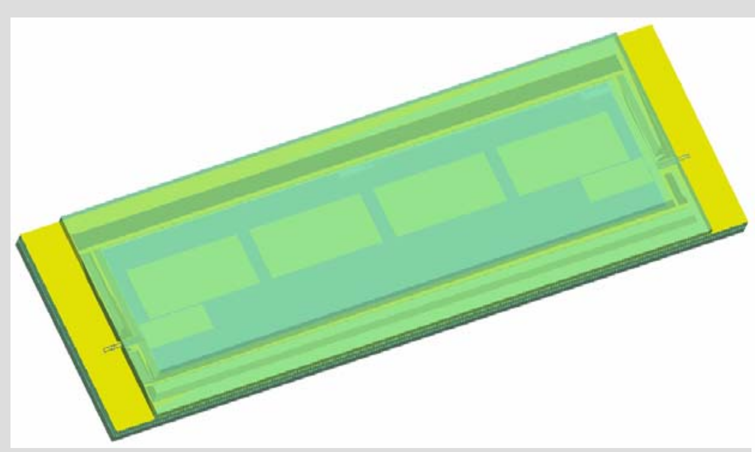
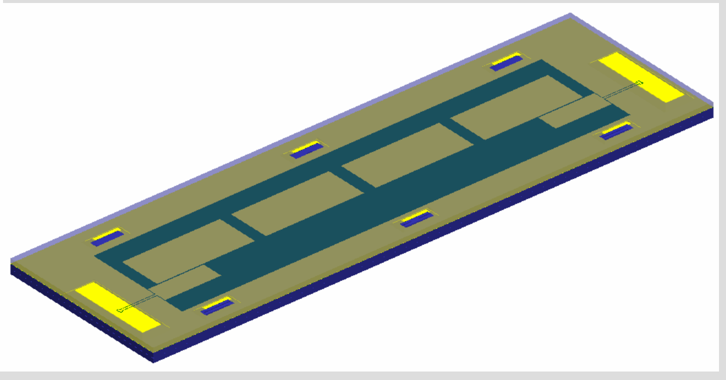
Development of the Packaging Design I

The design of packaging was improved step by step:





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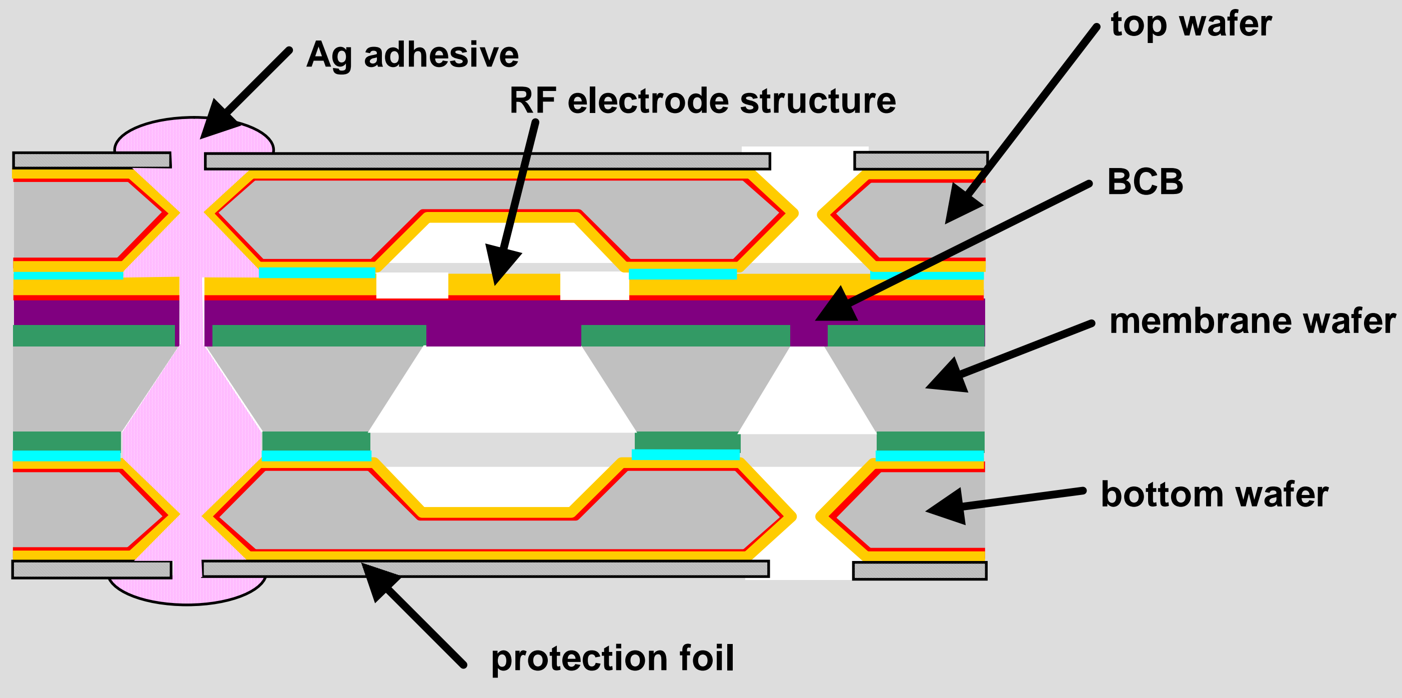
Development of the Packaging Design II



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Development of the Packaging Design III

Mask change

top wafer

Mask change

middle wafer

input / output - coupling

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Processes Packaging I

check wafer level / doku

grouping of wafer / doku

combine top wafer to membrane wafer

first underfill

check justage top wafer / membrane wafer

combine stack and bottom wafer

second underfill

check justage / doku wafer stack

plasma processing

apply conducting adhesive

cleaning and prepare for sawing

sawing

remove devices from sawing foil

measure / check whole underfill process

pack devices and doku

finalise control steps

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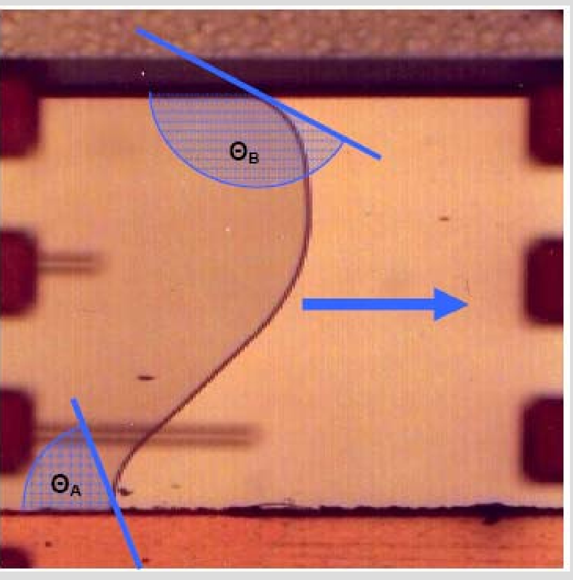
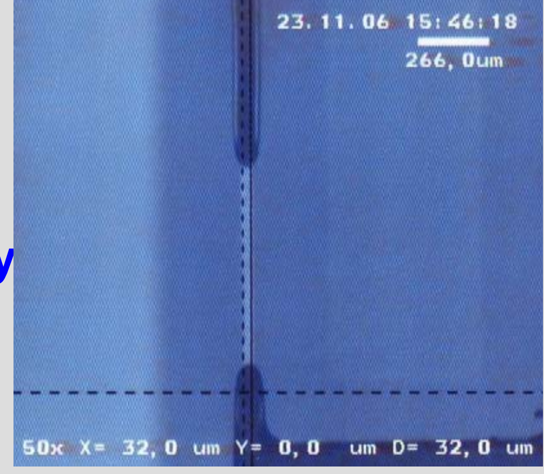
Processes Packaging II

Underfill Process:



The move of the expansion line of underfill (50°C)between Si and glass

The expansion line's velocity reduces at narrow lines.



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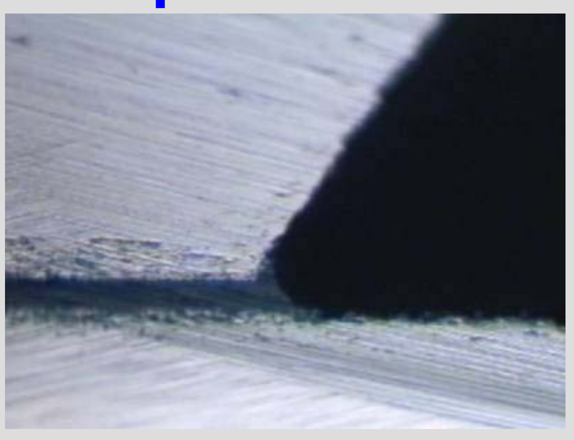
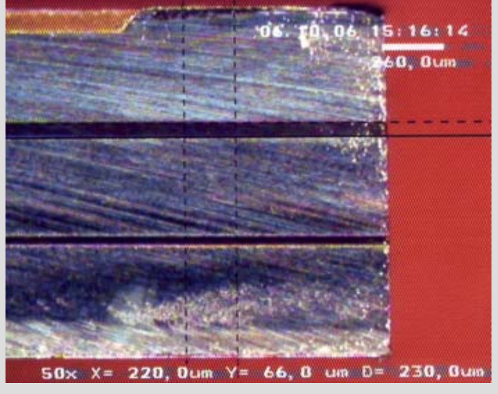
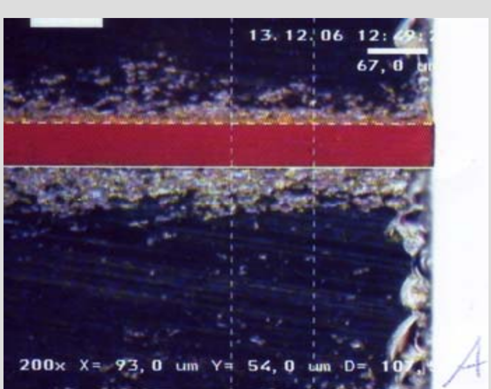
Processes Packaging III

Complete Underfill Process:



by selecting proper process parameters a well defined flow of underfill can be achived





complete / non - complete fill of device edges

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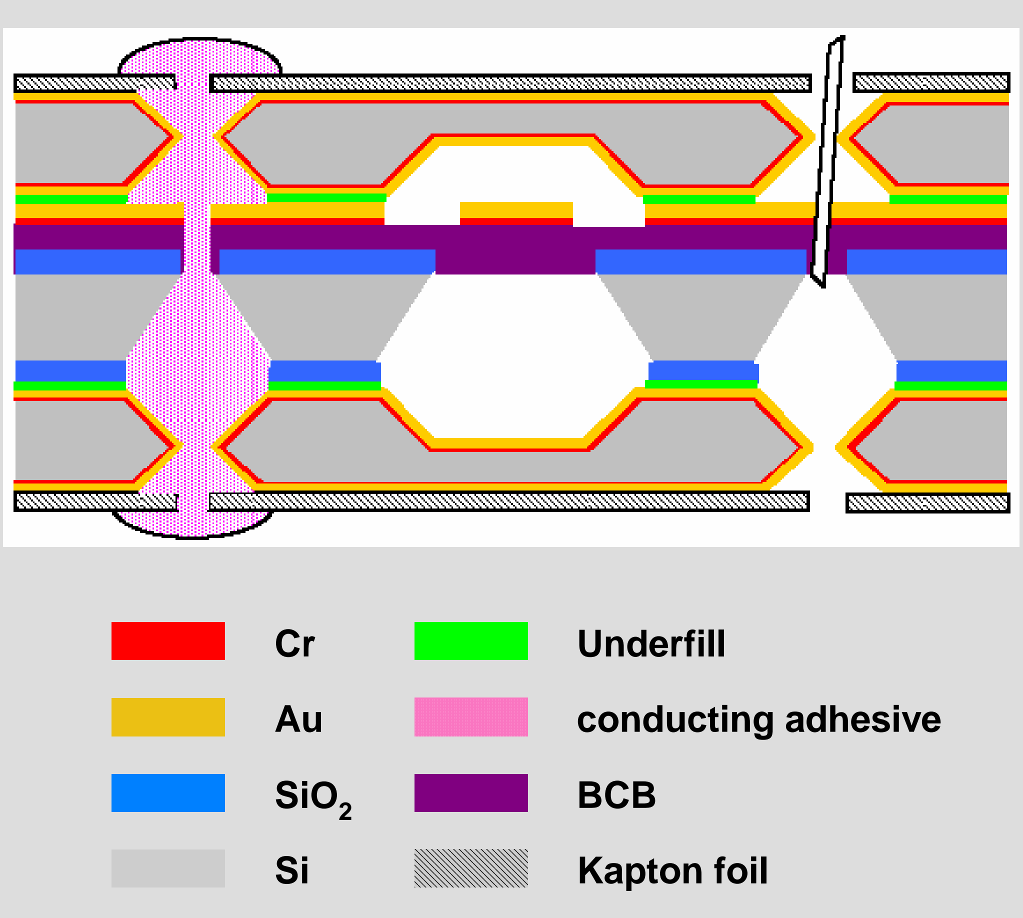
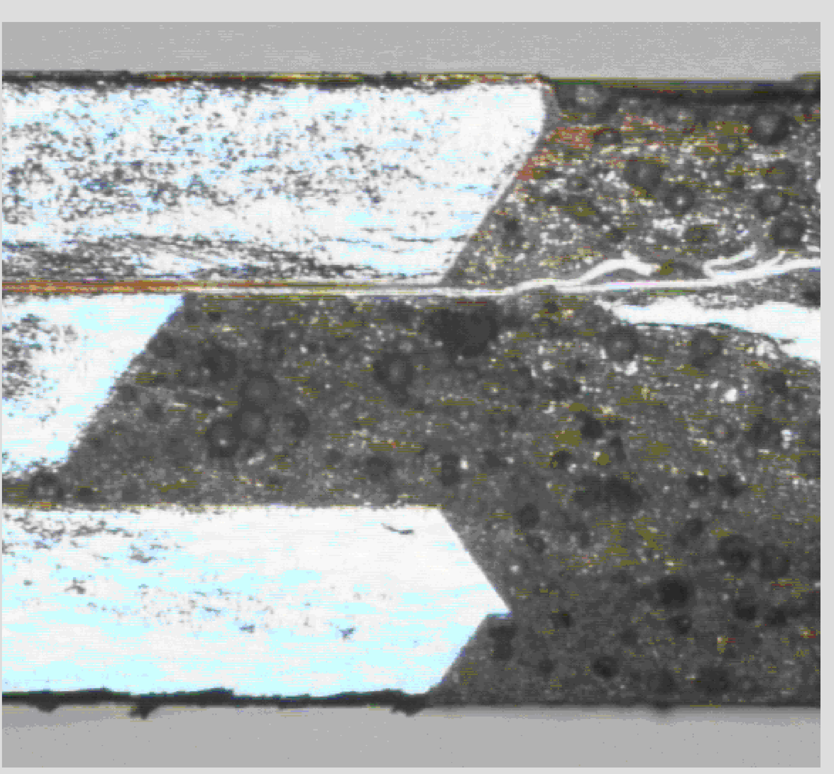
Processes Packaging IV

conducting adhesive glue process (I):



Processes Packaging V

conducting adhesive glue process (II):



by selecting proper
process parameters
a well defined flow
of conducting adhesive
can be achieved

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realised filter

- picture

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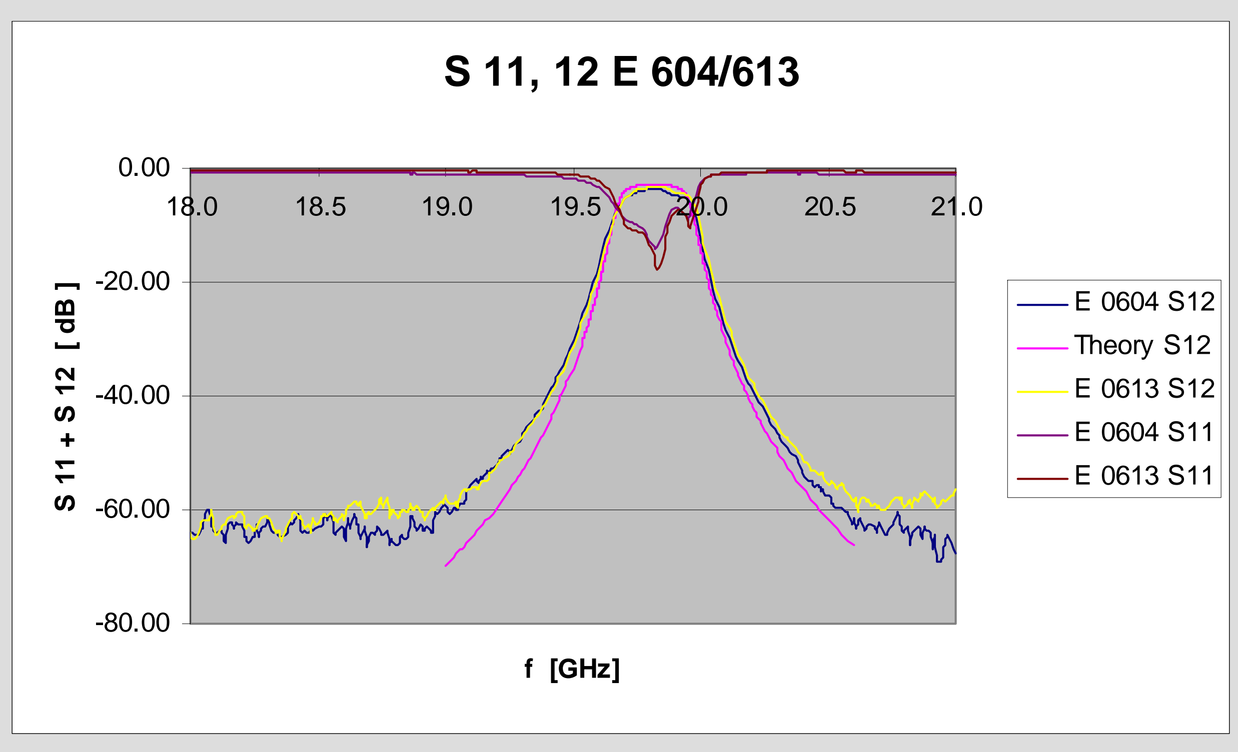
realised filter

- RF – Measurements I (overview)



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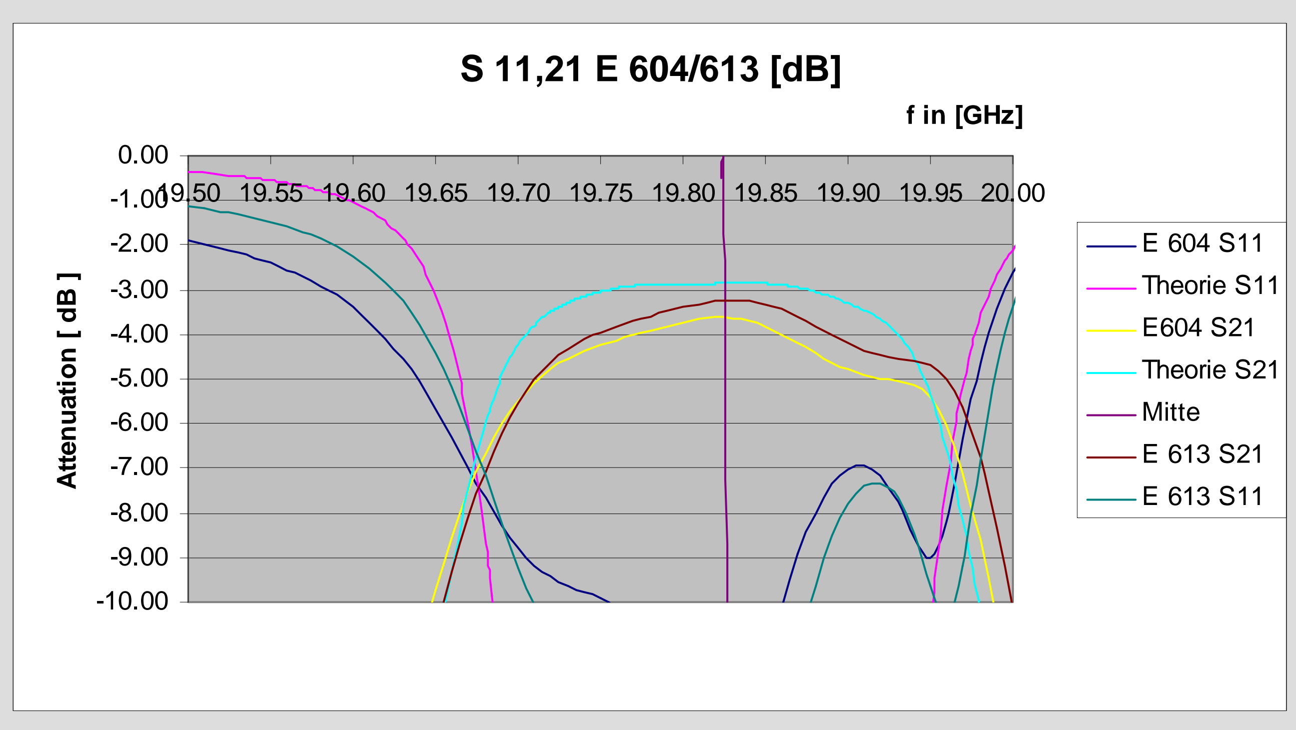
realised filter

- RF – Measurements II (detail)



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Outlook I

A new project is launched with ESA to qualify processes for space applications and to name RMT on the preferred supplier list.

RMT is enlarging its offer to leading system houses as an industrial supplier to use its facilities for improved RF – designs.

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Outlook II

RMT is open to realise new customer specific designs.

All these designs are developed with the customer and remain customers property.