ESTEC's **Materials and Electrical Components laboratory** capabilities on testing passive components

14 October 2016 - Joaquín José Jiménez Carreira

AGENDA

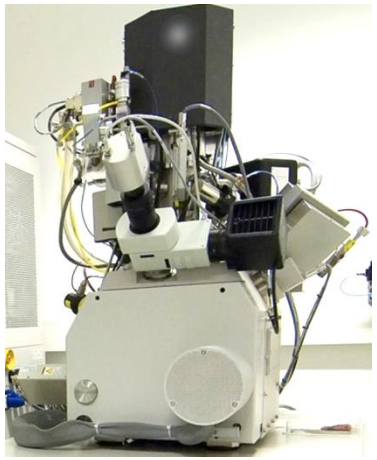
1. **Introduction to the lab**
2. X-ray testing
3. CT scan
4. IR techniques
5. C-SAM
6. Sectioning
7. SEM
8. FIB
9. Other techniques

INTRODUCTION TO THE LAB

- Support to ESA projects
- Support to ESA technology programs
- Standardization and qualification activities
- Collaborative activities with the space community

- Customer focus:
  - Time critical
  - Non-routine
  - Impartial/independent approach
  - Special confidentiality constraints

- Core functions
  1. Failure analysis (FA)
  2. Constructional analysis (CA)
  3. Destructive physical analysis (DPA)
  4. Miscellaneous investigations (MI)
  5. Radiation testing



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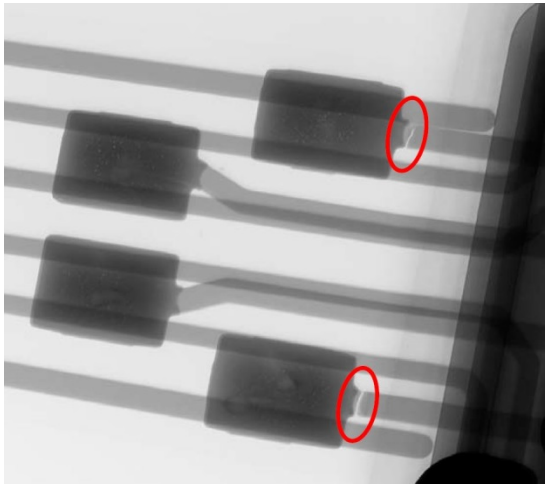
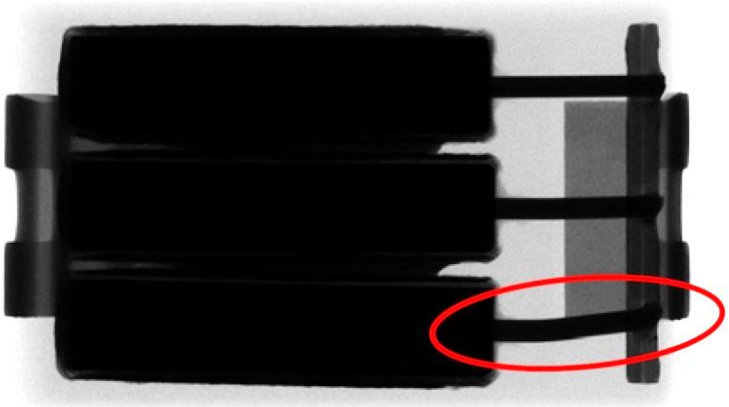
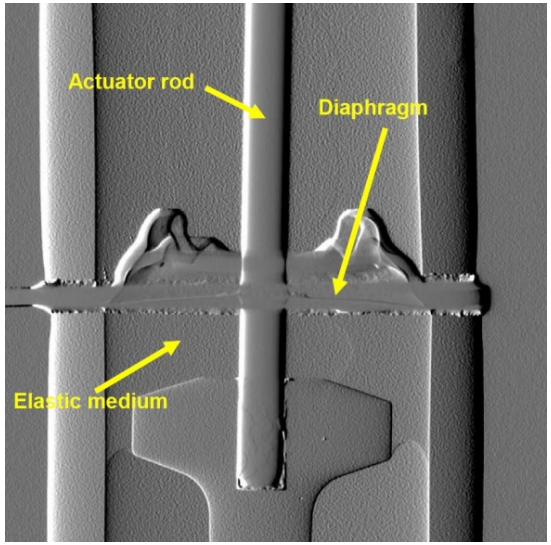
X-ray testing

1. X-ray testing

2. Examples of applications:
   - Broken pad in flex circuit
   - Internal features of tantalum capacitors
   - Internal structure of relays







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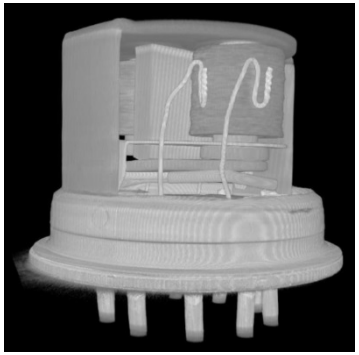
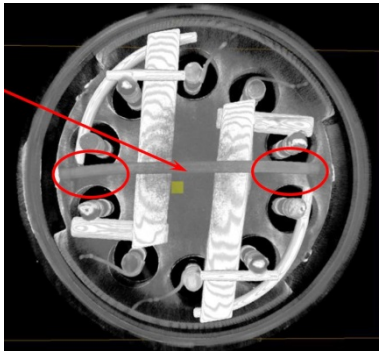
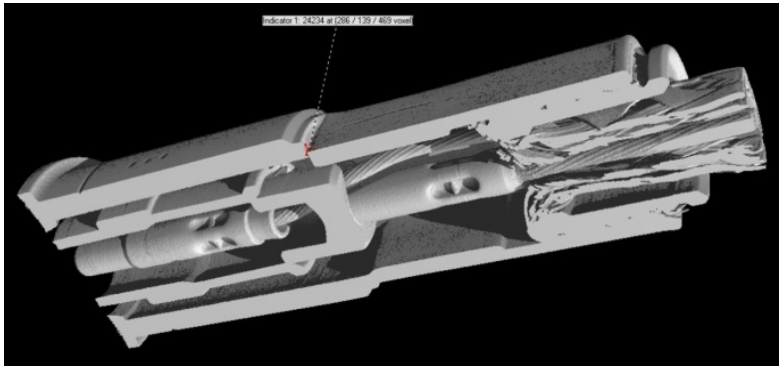
Computerized Tomography (CT) scan

- Currently, two CT scan X-ray instruments at the laboratory
  - Single beam instrument: 160kV x-ray tube with CT scan tray
  - Double beam instrument: 180kV (high res) / 300kV (high density samples)
- Examples of applications

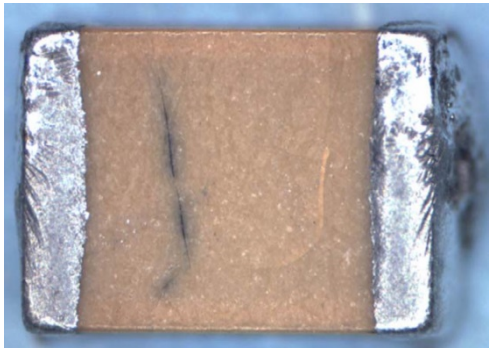
a) Features in relays / connectors

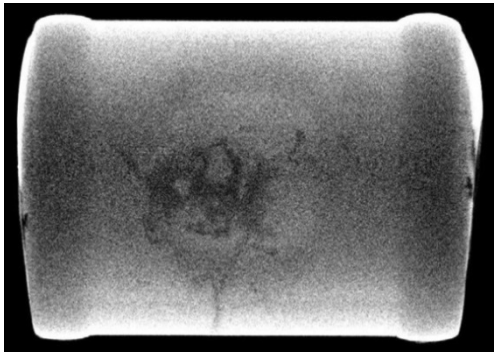






b) Cracks in multilayer capacitors





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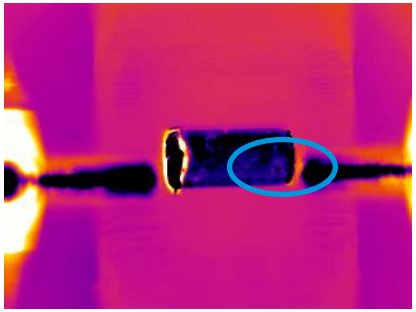
IR (Infra Red) techniques

- Infrared camera
- Examples of applications:

a) Failure location in chip capacitors



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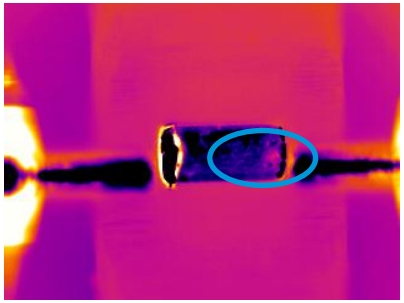

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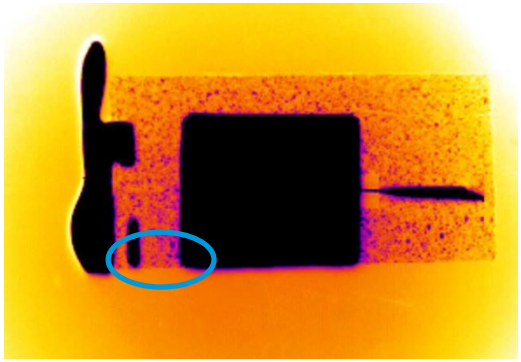
b) Failure location in tantalum capacitor



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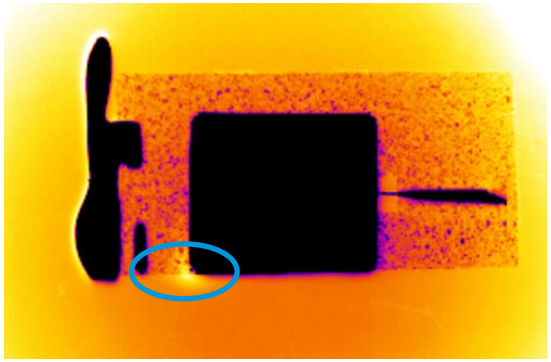

biased

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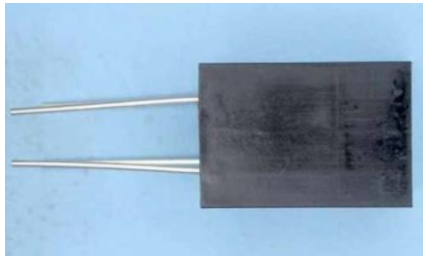
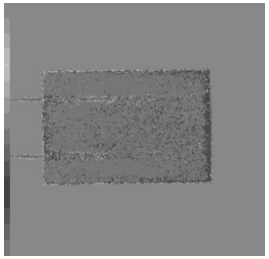
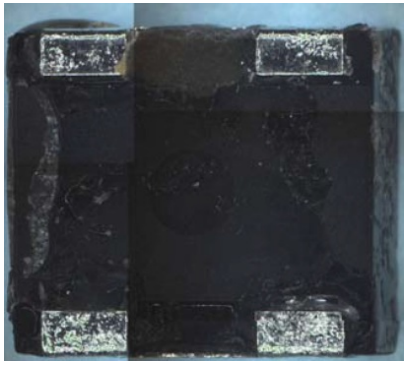
C-SAM

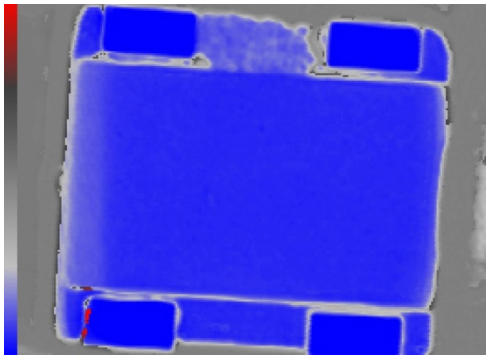
- C-mode Scanning Acoustic Microscopy
- Examples of applications:
    a. Delamination in polyester capacitor

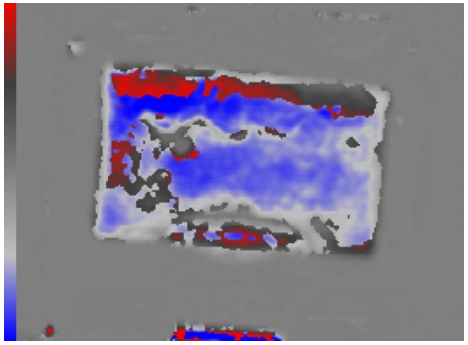




    a. Delamination in tantalum capacitor







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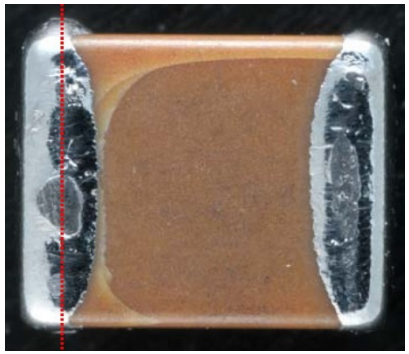
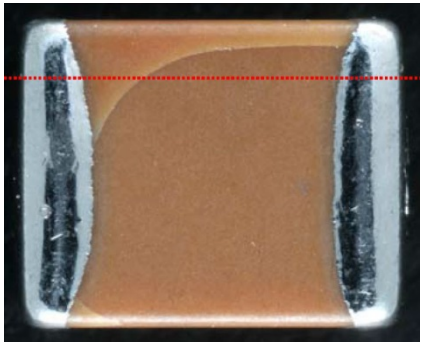
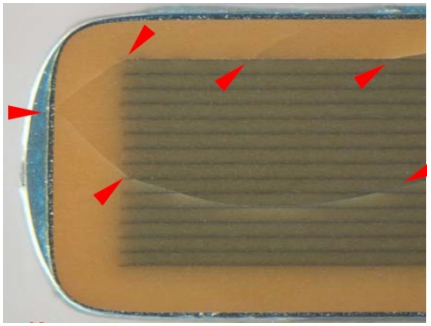
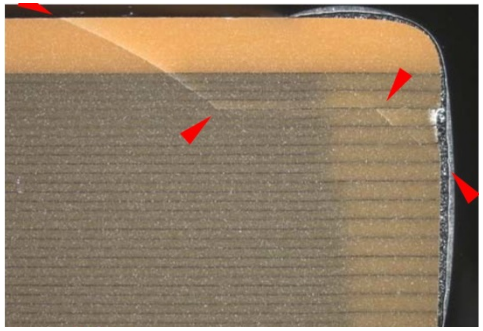
Sectioning

1. The objective is to expose features of interest, usually failure locations
2. Examples of applications:
    - Expose cracks in multilayer capacitors









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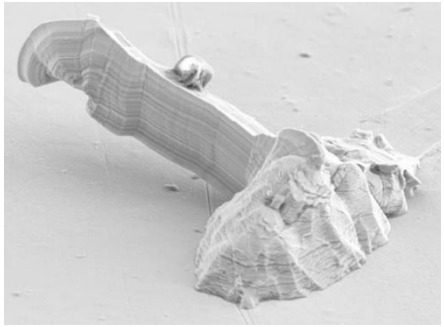
SEM (Scanning Electron Microscope)

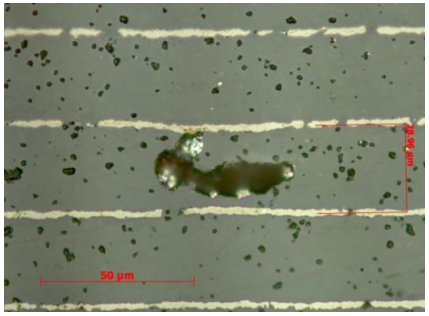
Scanning Electron Microscope (SEM): four instruments currently at the lab

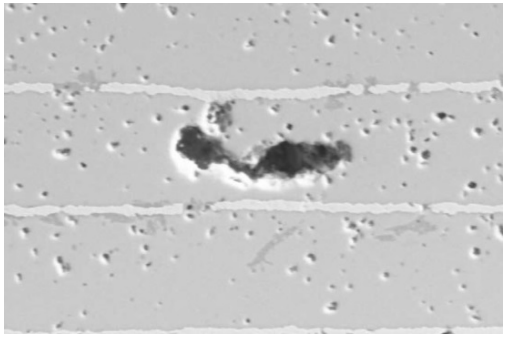
Examples of applications:

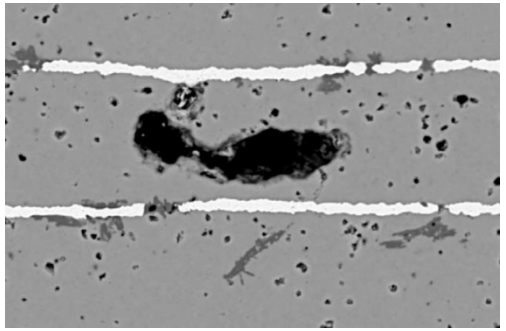
1. Exposing tin whiskers



2. Exposing internal voids







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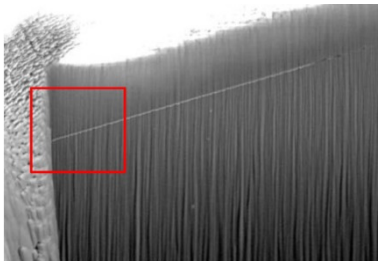
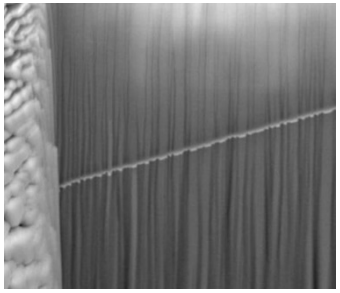
FIB (Focused Ion Beam)

Focused Ion Beam: one **plasma FIB** and one **dual beam FIB** currently at the lab

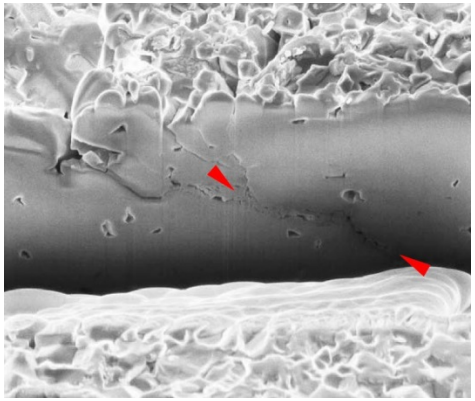
Example of applications:

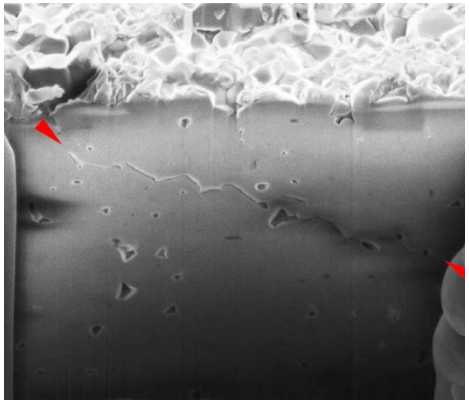
1. Exposing dendrites





2. Exposing internal cracks





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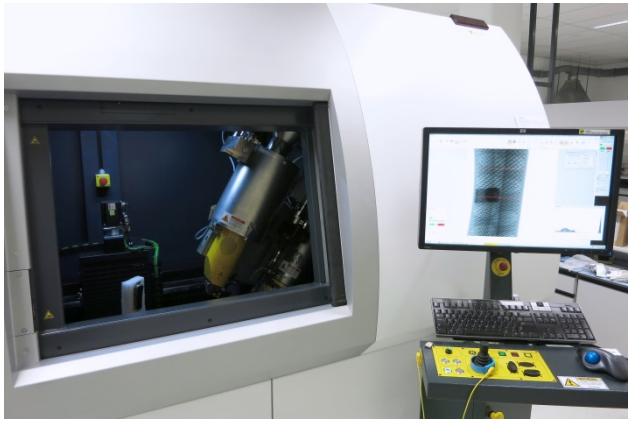
Other techniques

- Vibration testing
- Mechanical shock
- PIND
- Leak testing
- RF/MW measurements
- DC electrical measurements
- Emission microscopy
- Co-60 gamma source
- Bond pull testing
- Sputter coating
- XRF
- Visual inspection

- Laser decapsulation
- Chemical decapsulation
- Metal packages decapsulation
- Precision milling backpolisher



QUESTIONS?

ESTEC's Materials and Electrical Components Laboratory

Thank you very much
for your attention!

More info about the laboratory
available at **www.esa.int**