



<b>Publication Year</b>	2005
<b>Acceptance in OA @INAF</b>	2024-03-07T10:33:24Z
<b>Title</b>	ECCOSORB Failure Analysis
<b>Authors</b>	Brighenti, Alberto; CUTTAIA, FRANCESCO; DE ROSA, Adriano Giuseppe; Orsi, Giordano; TERENCEI, LUCA; et al.
<b>Handle</b>	<a href="http://hdl.handle.net/20.500.12386/34918">http://hdl.handle.net/20.500.12386/34918</a>
<b>Number</b>	PL-LFI-TES-TN-015



**TITLE:** **ECCOSORB failure analysis**

**DOC. TYPE:** TECHNICAL NOTE

**PROJECT REF.:** PL-LFI-TES-TN-015

**PAGE:** I of V, 45

**ISSUE/REV.:** 1.0

**DATE:** May 2005

<p><b>Prepared by</b></p>	<p><b>A. BRIGHENTI</b> <b>F. CUTTAIA</b> <b>A. DE ROSA</b> <b>G. ORSI</b> <b>L. TERENCEI</b> <b>L. VALENZIANO</b></p> <p><b>LFI</b> <b>4K RL Development Team</b></p>	<p><b>Date:</b> <b>Signature:</b></p>	<p><b>May 20<sup>th</sup>, 2005</b></p> <hr/>
<p><b>Agreed by</b></p>	<p><b>L.VALENZIANO</b> <b>LFI</b> <b>4K RL Development Team</b></p>	<p><b>Date:</b> <b>Signature:</b></p>	<p><b>May 20<sup>th</sup>, 2005</b></p> <hr/>
<p><b>Agreed by</b></p>	<p><b>C. BUTLER</b> <b>LFI</b> <b>Program Manager</b></p>	<p><b>Date:</b> <b>Signature:</b></p>	<p><b>May 20<sup>th</sup>, 2005</b></p> <hr/>
<p><b>Approved by</b></p>	<p><b>N. MANDOLESI</b> <b>LFI</b> <b>Principal Investigator</b></p>	<p><b>Date:</b> <b>Signature:</b></p>	<p><b>May 20<sup>th</sup>, 2005</b></p> <hr/>



## DISTRIBUTION LIST

Recipient	Company / Institute	E-mail address
T. PASSVOGEL	ESA – Noordwijk	<a href="mailto:tpassvog@estec.esa.nl">tpassvog@estec.esa.nl</a>
G. CRONE	ESA – Noordwijk	<a href="mailto:Gerald.Crone@esa.int">Gerald.Crone@esa.int</a>
J. MARTI-CANALES	ESA – Noordwijk	<a href="mailto:Javier.Marti.Canales@esa.int">Javier.Marti.Canales@esa.int</a>
J. TAUBER	ESA – Noordwijk	<a href="mailto:Jan.Tauber@esa.int">Jan.Tauber@esa.int</a>
J. RAUTAKOSKI	ESA – Noordwijk	<a href="mailto:Jan.Rautakoski@esa.int">Jan.Rautakoski@esa.int</a>
B. COLLAUDIN	ALCATEL – Cannes	<a href="mailto:bernard.collaudin@space.alcatel.fr">bernard.collaudin@space.alcatel.fr</a>
J.P. CHAMBELLAND	ALCATEL – Cannes	<a href="mailto:Jean-Philippe.Chambelland@space.alcatel.fr">Jean-Philippe.Chambelland@space.alcatel.fr</a>
N. MANDOLESI	IASF/INAF – Bologna	<a href="mailto:mandolesi@bo.iasf.cnr.it">mandolesi@bo.iasf.cnr.it</a>
C. BUTLER	IASF/INAF – Bologna	<a href="mailto:butler@bo.iasf.cnr.it">butler@bo.iasf.cnr.it</a>
M. BERSANELLI	UNIMI – Milano	<a href="mailto:Marco.bersanelli@mi.infn.it">Marco.bersanelli@mi.infn.it</a>
D. MENNELLA	UNIMI – Milano	<a href="mailto:mennella@mi.iasf.cnr.it">mennella@mi.iasf.cnr.it</a>
M. TOMASI	IASF/INAF – Milano	<a href="mailto:tomasi@mi.iasf.cnr.it">tomasi@mi.iasf.cnr.it</a>
M. BALASINI	ALENIA SPAZIO – LABEN	<a href="mailto:balasini.m@laben.it">balasini.m@laben.it</a>
G. CAFAGNA	ALENIA SPAZIO – LABEN	<a href="mailto:cafagna.g@laben.it">cafagna.g@laben.it</a>
M. MICCOLIS	ALENIA SPAZIO – LABEN	<a href="mailto:miccolis.m@laben.it">miccolis.m@laben.it</a>
R. SILVESTRI	ALENIA SPAZIO – LABEN	<a href="mailto:silvestri.r@laben.it">silvestri.r@laben.it</a>
P. LEUTENEGGER	ALENIA SPAZIO – LABEN	<a href="mailto:leutenegger.p@laben.it">leutenegger.p@laben.it</a>
L. PAGAN	ALENIA SPAZIO – LABEN	<a href="mailto:pagan.l@laben.it">pagan.l@laben.it</a>
4KRL Team - Bologna	INAF/IASF – Bologna	
RWG members		<a href="mailto:rwg@beta.jpl.nasa.gov">rwg@beta.jpl.nasa.gov</a>
LFI SPCC	IASF/INAF – Bologna	<a href="mailto:lfispcc@bo.iasf.cnr.it">lfispcc@bo.iasf.cnr.it</a>







## TABLE OF CONTENTS

<b>1</b>	<b>SCOPE .....</b>	<b>1</b>
1.1	PURPOSE .....	1
1.2	DOCUMENT OVERVIEW.....	1
1.3	TERMS AND ACRONYMS.....	1
<b>2</b>	<b>APPLICABLE AND REFERENCE DOCUMENTS.....</b>	<b>2</b>
2.1	APPLICABLE DOCUMENTS .....	2
2.2	REFERENCE DOCUMENTS .....	2
<b>3</b>	<b>FAILURE REPORT .....</b>	<b>3</b>
<b>4</b>	<b>FAILURE ANALYSIS .....</b>	<b>7</b>
<b>5</b>	<b>TEST PLAN.....</b>	<b>12</b>
5.1	TEST ON ECCOSORB SAMPLES .....	12
5.1.1	<i>Chemical test 1: immersion in acetone .....</i>	<i>12</i>
5.1.2	<i>Chemical test 2: immersion in isopropyl alcohol .....</i>	<i>12</i>
5.1.3	<i>Chemical test 3: acetone + ultrasound cleaning.....</i>	<i>12</i>
5.1.4	<i>Chemical test 4: isopropyl alcohol + ultrasound cleaning .....</i>	<i>12</i>
5.1.5	<i>Effect of ultrasound cleaning on bulk material.....</i>	<i>12</i>
<b>6</b>	<b>TEST PROCEDURE.....</b>	<b>12</b>
<b>7</b>	<b>GENERAL TEST CONDITION .....</b>	<b>13</b>
7.1	AMBIENT .....	13
7.2	TEST INSTRUMENT .....	13
7.2.1	<i>Ultrasonic cleaning bath.....</i>	<i>13</i>
7.3	VISUAL INSPECTION.....	14
<b>8</b>	<b>TEST PROCEDURE .....</b>	<b>15</b>
8.1	TEST A – ULTRASONIC ACETONE BATH .....	15
8.2	TEST B – ACETONE BATH .....	15
8.3	TEST C – ULTRASONIC WATER BATH.....	15
8.4	TEST D – WATER BATH .....	16
8.5	TEST E – TOLUENE BATH.....	16
8.6	TEST F – GE GLUE (REACTIVATE WITH TOLUENE) TEST .....	16
<b>9</b>	<b>TEST SPECIMENS.....</b>	<b>18</b>
<b>10</b>	<b>TEST REPORT .....</b>	<b>19</b>
10.1	SPECIMEN 1A – CROSS @44GHZ ACETONE&ULTRASOUND.....	19
10.2	SPECIMEN 1B – PYRAMIDS @44GHZ ACETONE&ULTRASOUND.....	21
10.3	SPECIMEN 2 – CROSS @30GHZ ACETONE&ULTRASOUND.....	24
10.4	SPECIMEN 3A – CROSS@30GHZ ACETONE .....	27





---

10.5	SPECIMEN 3B – CROSS@44GHZ ACETONE .....	29
10.6	SPECIMEN 4 – SANDWICH AL6061-ECR110-ECR BONDED ACETONE.....	31
10.7	SPECIMEN 5A – BASE@44GHZ ACETONE&ULTRASOUND .....	32
10.8	SPECIMEN 5B – SANDWICH AL6061-ECR110-ECR BONDED ACETONE&ULTRASOUND .....	33
10.9	SPECIMEN 6 – CROSS@30GHZ WATER&ULTRASOUND .....	34
10.10	SPECIMEN 7 – BASE@44GHZ ACETONE.....	35
10.11	SPECIMEN 8 – BASE@30GHZ ACETONE.....	37
10.12	SPECIMEN 9 – BULK TOLUENE.....	38
10.13	SPECIMEN 10 – PYRAMID ACETONE .....	41
10.14	SPECIMEN 11 – PLATE WATER&ULTRASOUND.....	42
10.15	SPECIMEN 12 – BULK WATER .....	43
10.16	SPECIMEN 13 – BULK GE GLUE REACTIVATED.....	44





# 1 SCOPE

## 1.1 Purpose

A failure on some of the 4KRL QM parts was observed after the cryo cycles. A detailed activity was started to study the failure, to identify its causes, to find a solution before the assembly of the FM unit.

The purpose of this document is to report details of the failure, to describe the experimental activity to solve the problem, to report the results of this activity.

## 1.2 Document Overview

## 1.3 TERMS and ACRONYMS

4K RL	4K Reference Load
CMB	Cosmic Microwave Background
EBB	Elegant Bread Board
FEM	Front End Module
FM	Flight Model
FPU	Focal Plane Unit
FS	Flight Spare
HFI	High Frequency Instrument
I/F	Interface
IL	Insertion Loss
LFI	Low Frequency Instrument
MS	Mounting Structure
N/A	Not Applicable
PD	Prototype Demonstrator
QM	Qualification Model
RH	Reference Horn
RL	Return Loss
RT	Reference Target
SS	Spin-Synchronous
TBC	To Be Confirmed
TBD	To Be Defined
TBR	To Be Refined
ThL	Thermal Link
WG	Waveguide





## 2 APPLICABLE AND REFERENCE DOCUMENTS

### 2.1 *Applicable documents*

- AD 1: FIRST/Planck Instrument Interface Document, Part A (SCI-PT-IIDA-04624, 2/0)
- AD 2: FIRST/Planck Instrument Interface Document, Part B (SCI-PT-IIDB/LFI-04142, 2/0)
- AD 3: LFI Interface Control Document (PL-LFI-PST-ID-010, 2.0)
- AD 4: LFI/HFI Interface Document (PL-LFI-PST-ID-001, 1.0)
- AD 5: LFI Specification (PL-LFI-PST-SP-001, 3.0)
- AD 6: Planck LFI Instrument Design and Development Plan (PL-LFI-PST-PL-002, 2.0)
- AD 7: Planck LFI Product Assurance Plan (PL-LFI-PST-PL-003, 3.0)
- AD 8: Planck LFI Assembly Integration & Verification Plan (PL-LFI-PST-PI-004, 3.0)
- AD 9: FIRST/Planck Operations Interface Requirements Document (SCI-PT-RS-07360, 2/1)
- AD 10: LFI Configuration and Data Management CADM Plan (PL-LFI-PST-PL-001, 3.0)
- AD 11: LFI Instrument Deliverable Documentation List (DDL) (PL-LFI-PST-LI-007, 1.0)
- AD 12: 4K Reference Load Requirement Specification (PL-LFI-TES-SP-001, 2.0)

### 2.2 *Reference documents*







### 3 FAILURE REPORT

Some cracks on the ECCOSORB CR110 cross have been observed on one of the 30GHz targets (id parte) after the 15<sup>th</sup> thermal cycle to 4K. Flakes are also visible.

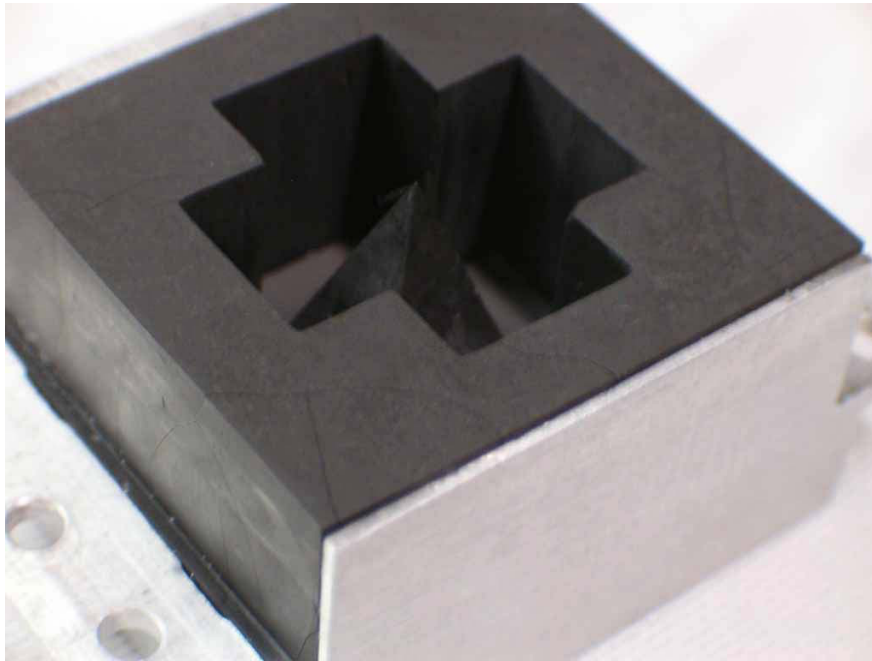


Figure 1: Images of the damaged target after the cryo cycles.



Figure 2: Lateral view of the damaged target



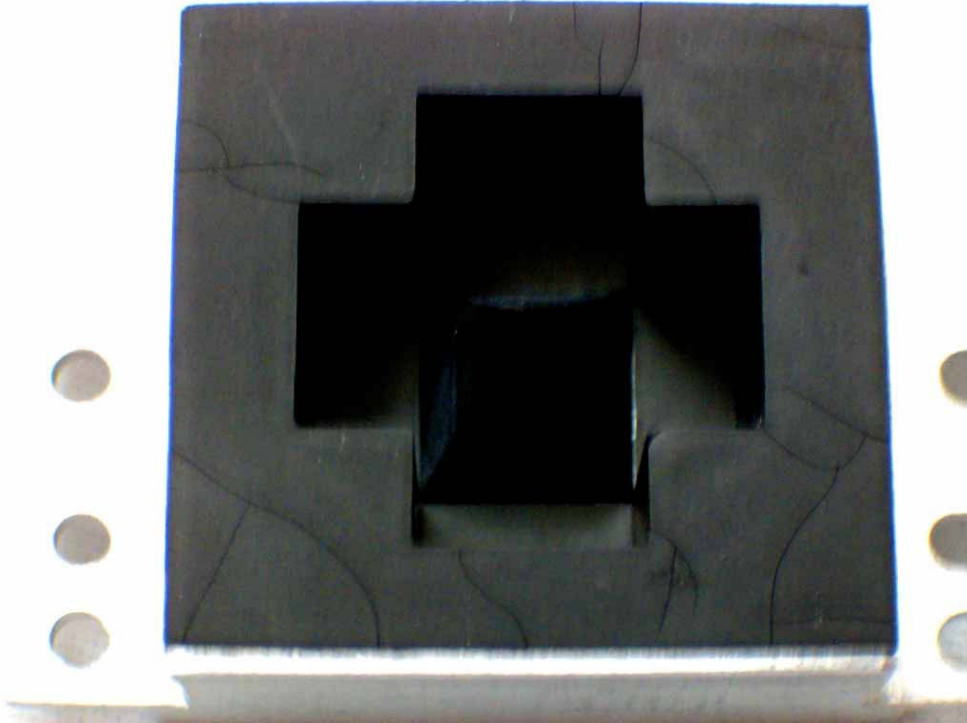


Figure 3: Another view of the damaged 30GHz target

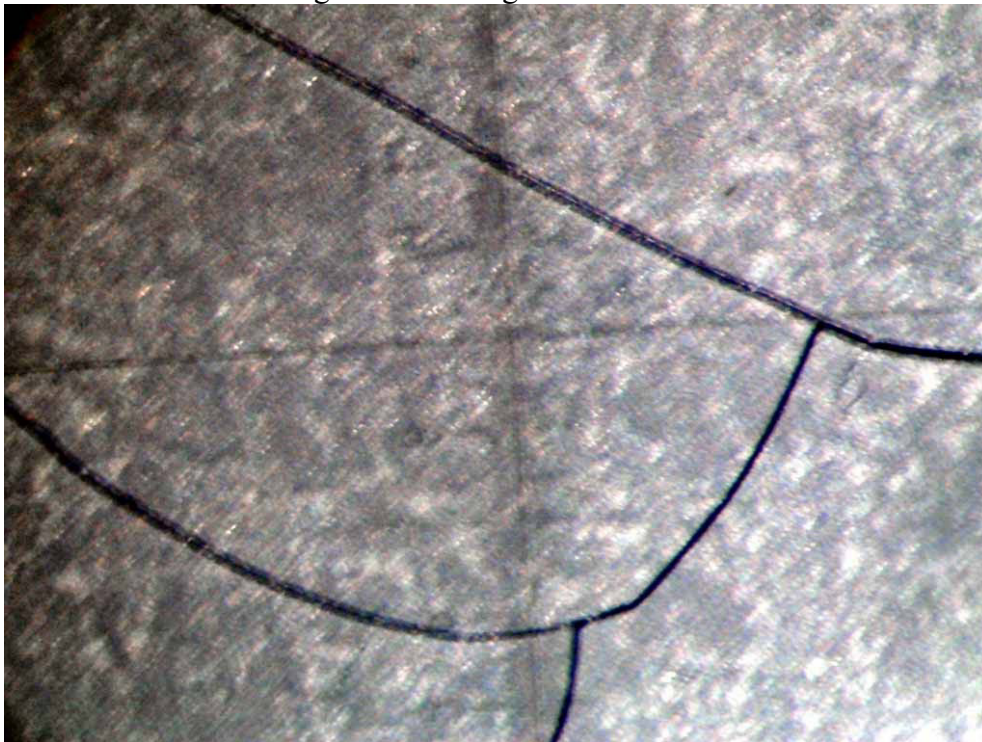


Figure 4: Details of some of the cracks view through a microscope.



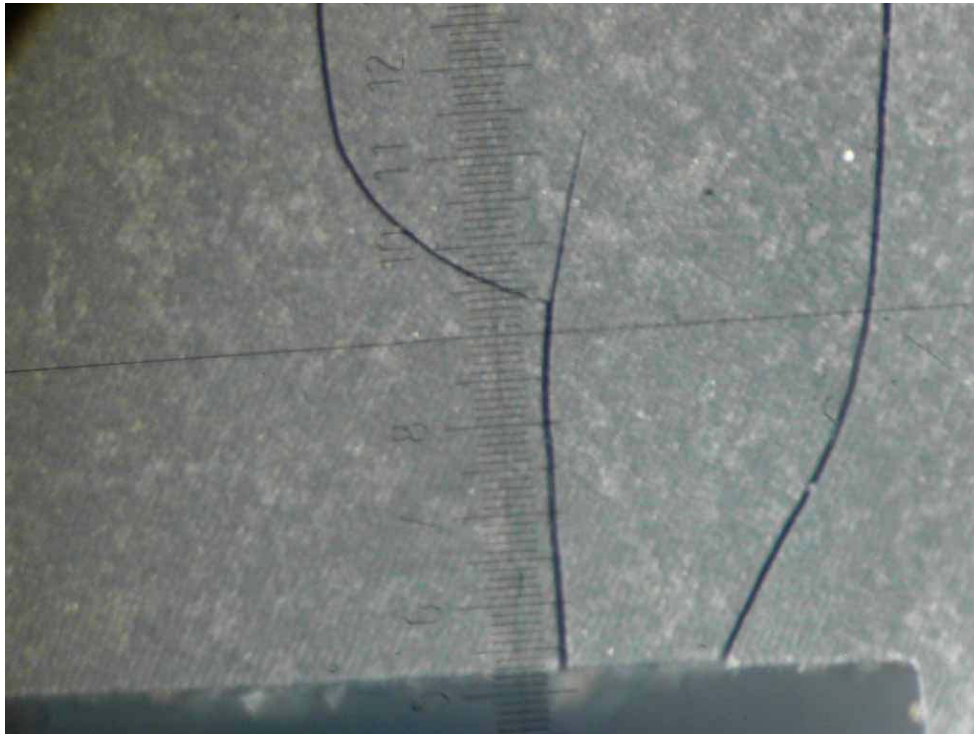


Figure 5: Details of some of the cracks view through a microscope: a reference scale is also visible.

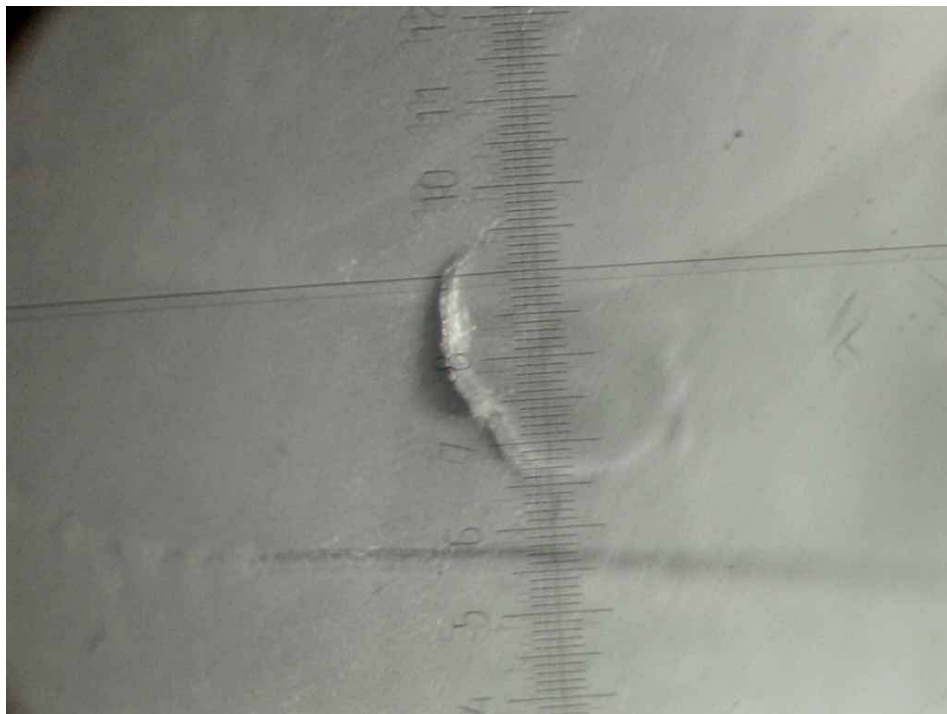


Figure 6: Details of one of the flakes view through a microscope





Figure 7: Details View through a microscope of the crack on the 44 GHz target (id parte)





## 4 FAILURE ANALYSIS

The failure was analysed for possible causes. Analisi del failure del target a 30GHz durante i cicli termici

L. Valenziano – IASF-Bo  
4/3/2005

‘Failure tree’ is reported in XX. It is compiled considering all the possible factors which can have been causes of the failure. They have then been studied to identify the actual problem areas and divide them in different level risk. Color code is as follows:

- Green boxes refer to excluded causes.
- Light blue boxes refer to possible causes (needs to be further investigated).
- Orange boxes indicate high probable causes (need to be considered).
- Red boxes indicate identified problem areas (mandatory to solve).

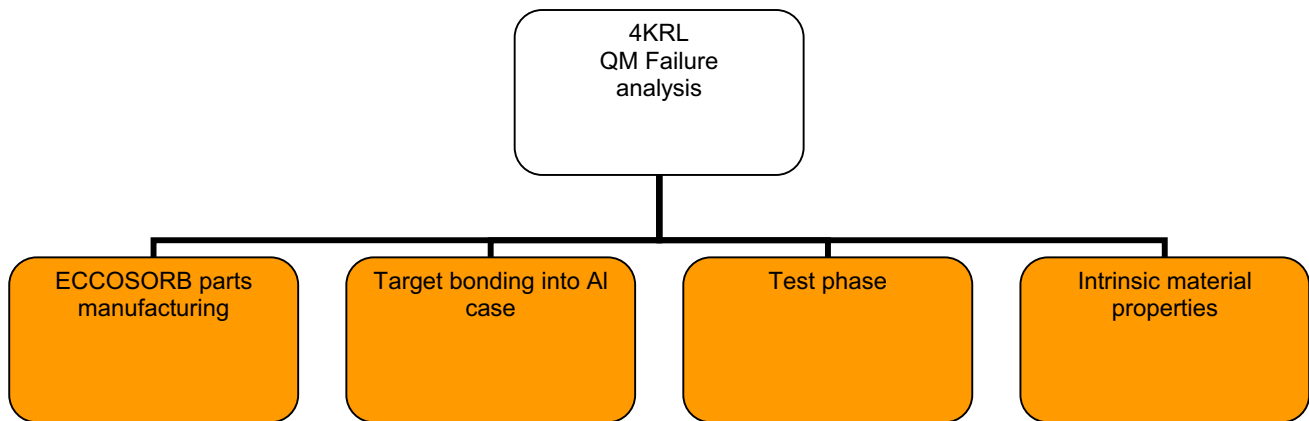
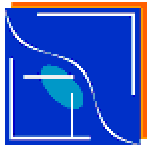


Figure 8: High level failure analysis tree

Albero di analisi del failure (livelli superiori – riepilogo)

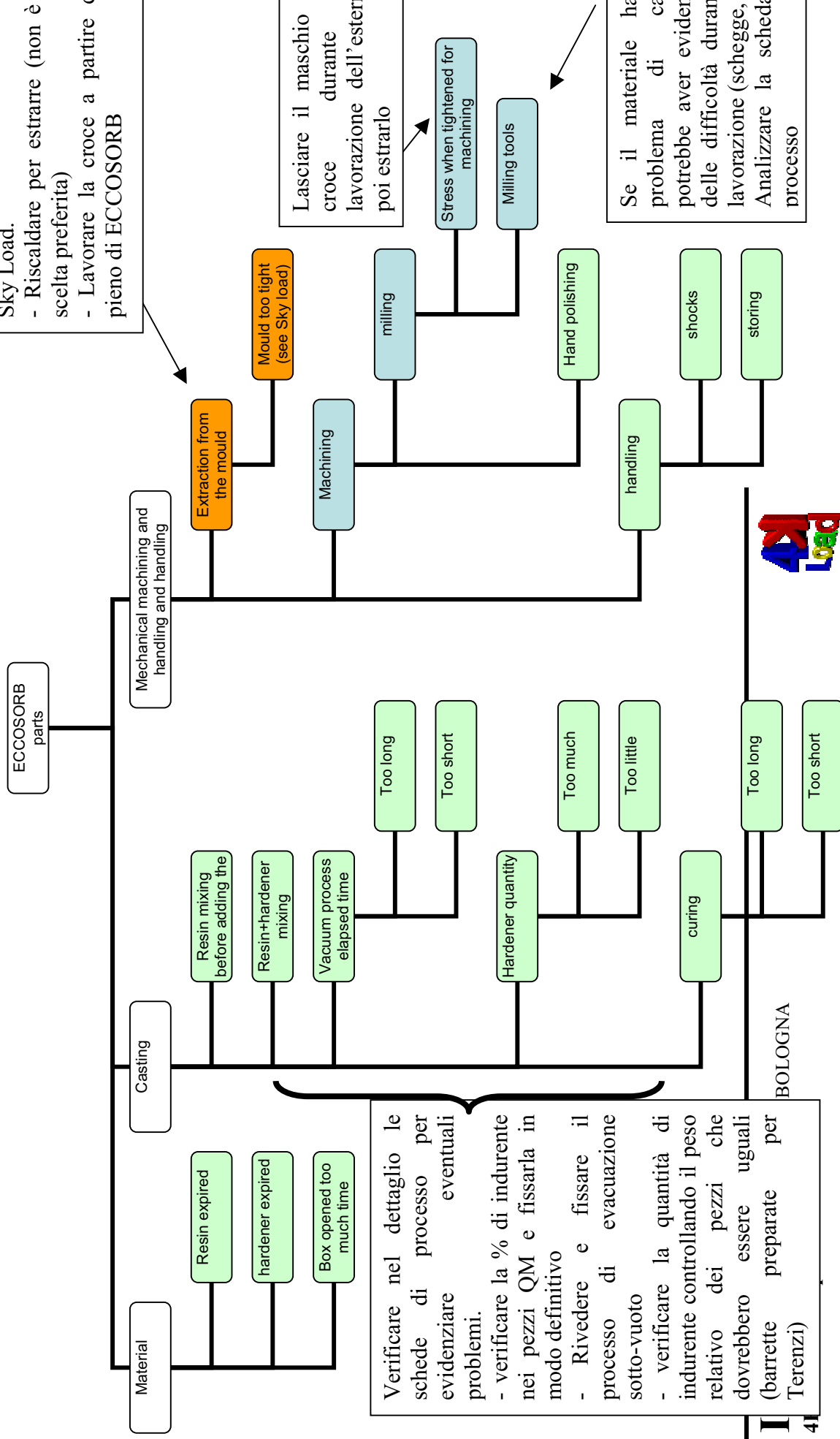




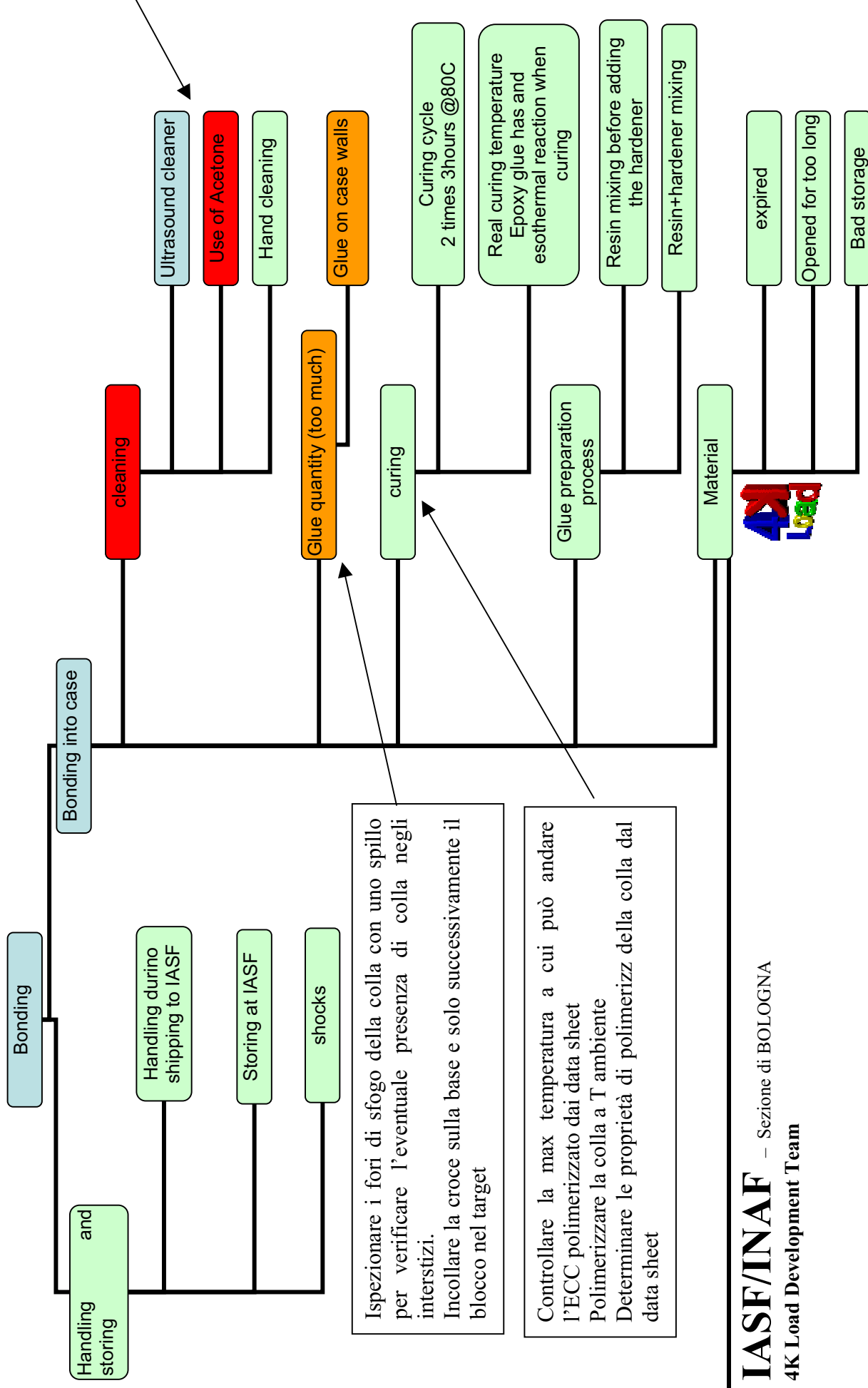
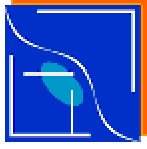
# ECCOSORB failure analysis

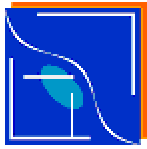
Document No.: PL-LFI-TES-TN-015  
 Issue/Rev. No.: 1.0  
 Date: May 2005  
 Page: 8

- Realizzare la croce con un stampo morbido, come fatto per Sky Load.
- Riscaldare per estrarre (non è scelta preferita)
- Lavorare la croce a partire da un pieno di ECCOSORB



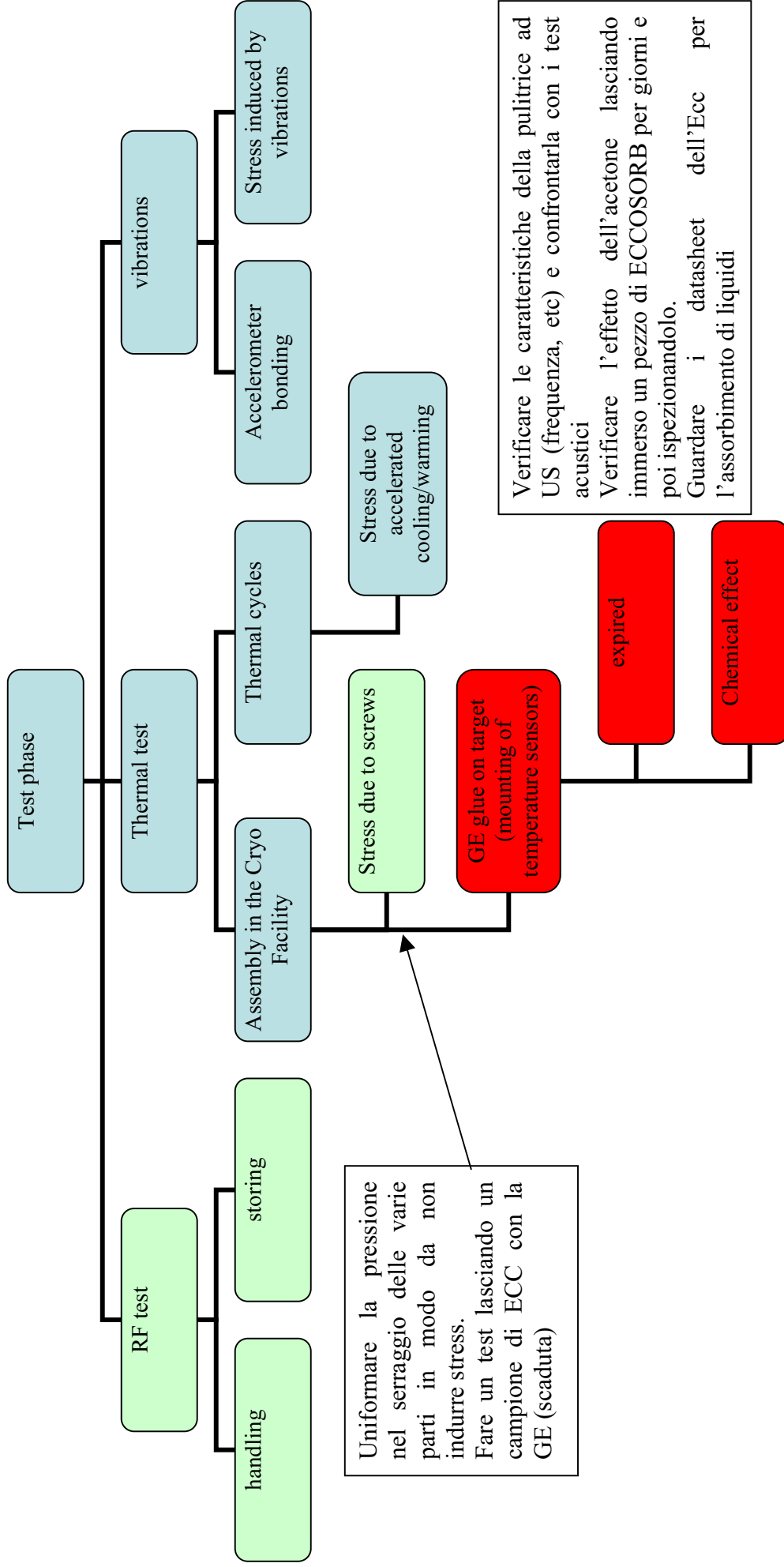
BOLOGNA



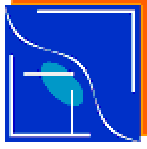


# ECCOSORB failure analysis

Document No.: PL-LFI-TES-TN-015  
 Issue/Rev. No.: 1.0  
 Date: May 2005  
 Page: 10

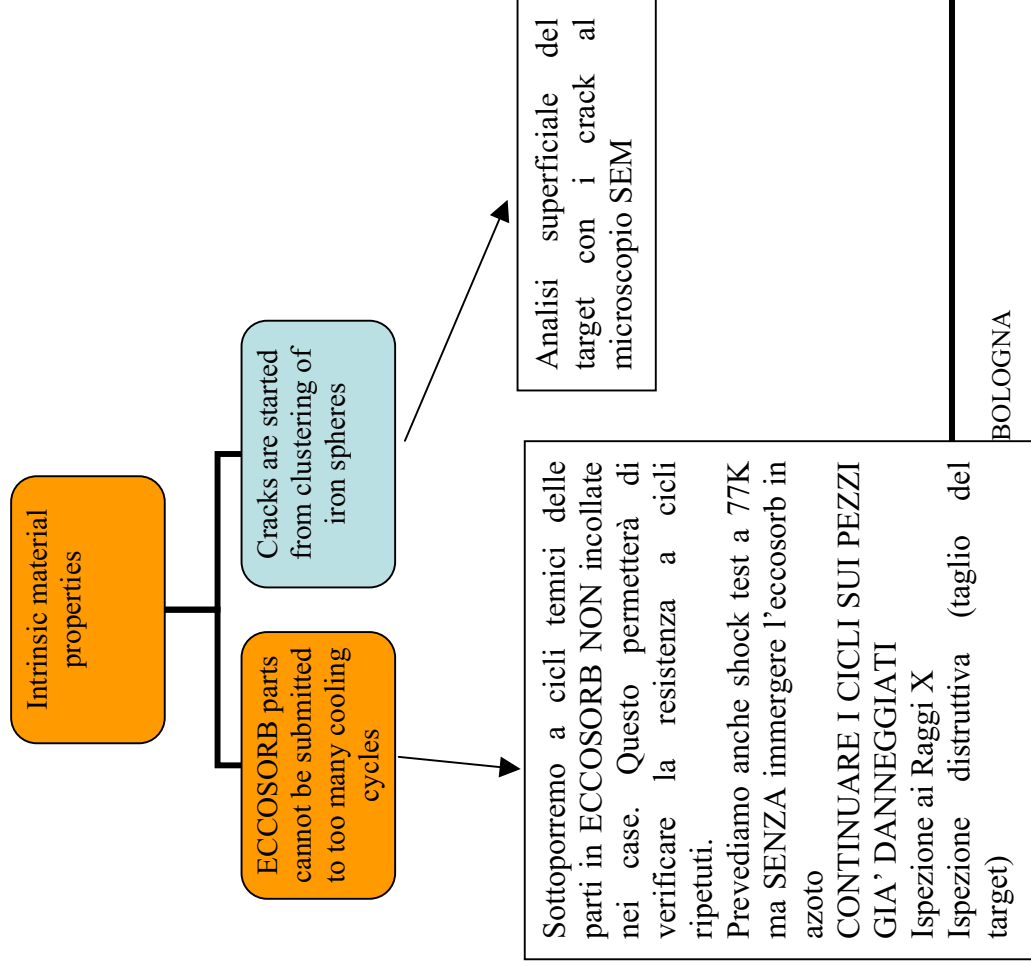






## ECCOSORB failure analysis

Document No.: PL-LFI-TES-TN-015  
Issue/Rev. No.: 1.0  
Date: May 2005  
Page: 11



BOLOGNA





## 5 TEST PLAN

A number of test are foreseen to verify the effect of different chemical and physical causes on the ECCOSORB.

### 5.1 Test on ECCOSORB samples

Samples of material (small blocks) are obtained from bars produced in the same batch with proto-flight targets. These samples will be used to test the effect of different cleaning and test procedures on a bulk material.

#### 5.1.1 Chemical test 1: immersion in acetone

Blocks will be immersed in acetone to test the effect on bulk material. Samples will be visually inspected at regular intervals to verify any damage occurred.

#### 5.1.2 Chemical test 2: immersion in isopropyl alcohol

Blocks will be immersed in isopropyl alcohol to test the effect on bulk material. Samples will be visually inspected at regular intervals to verify any damage occurred.

#### 5.1.3 Chemical test 3: acetone + ultrasound cleaning

Blocks will be immersed in acetone and then placed in a ultrasound cleaner to test the effect of sound-induced stress + chemical effect on bulk material. Samples will be visually inspected at regular intervals to verify any damage occurred.

#### 5.1.4 Chemical test 4: isopropyl alcohol + ultrasound cleaning

Blocks will be immersed in isopropyl alcohol and then placed in a ultrasound cleaner to test the effect of sound-induced stress + chemical effect on bulk material. Samples will be visually inspected at regular intervals to verify any damage occurred.

#### 5.1.5 Effect of ultrasound cleaning on bulk material

Block will be immersed in water and submitted to ultrasound cleaning to verify the effect of physical agents only. Samples will be visually inspected at regular intervals to verify any damage occurred.

## 6 TEST PROCEDURE





## 7 GENERAL TEST CONDITION

### 7.1 AMBIENT

All the test will be conducted in a clean room class 100000, or under a hood if required by safety condition.

Temperature [°C]	21
Humidity [%]	
Pressure [mbar]	

### 7.2 TEST INSTRUMENT

#### 7.2.1 Ultrasonic cleaning bath

The ultrasound cleaning cycle will be performed using a ultrasonic bath machine, model UTD-18, produced by Falc Instruments. The technical data are reported in the table below:

	<b>UTD-18</b>
Tank capacity [lt]	2.3
Frequency [kHz]	28.5/31
Peak power [W]	200
Power [W]	200
Heating amb +75°C	YES
Drain cock	YES
Timer [min]	2-22 (±5 sec.)
Internal dim L x W x H [mm]	135 x 297 x 65
Weight [kg]	4.5
Power supply [V @ Hz]	230 @50-60

Other technical data are available on [www.flacstruments.it](http://www.flacstruments.it).





### **7.3 VISUAL INSPECTION**

Unaided eye and microscope (up to 7x magnification).





## 8 TEST PROCEDURE

### 8.1 TEST A – ultrasonic acetone bath

A cleaning cycle of 22 minutes at 40°C will be performed in an acetone bath.  
 The cycles will be performed until a failure of the specimen, or after 12 cycles.  
 A visual inspection of the specimens will be done after each cycle.  
 The mass will be measured at last at the begin and at the end of the test.  
 The following table will be filled during the test.

DATE	TIME	TEST CONDITION	NOTE

### 8.2 TEST B – acetone bath

The specimen will be left in a backer with acetone for several hours until a failure, or after 100h  
 A visual inspection will be done after each 24h.  
 The mass will be measured at last at the begin and at the end of the test.  
 The following table will be filled during the test.

DATE	TIME	TEST CONDITION	NOTE

### 8.3 TEST C – ultrasonic water bath

A cleaning cycle of 22 minutes at 40°C will be performed in a water bath.  
 The cycles will be performed until a failure of the specimen, or after 8 cycles.  
 A visual inspection of the specimens will be done after each cycle.  
 The mass will be measured at last at the begin and at the end of the test.  
 The following table will be filled during the test.

DATE	TIME	TEST CONDITION	NOTE





**8.4 TEST D – water bath**

The specimen will be left in a backer with water for several hours until a failure, or after 100h  
A visual inspection will be done  
The mass will be measured at last at the begin and at the end of the test.  
The following table will be filled during the test.

DATE	TIME	TEST CONDITION	NOTE

**8.5 TEST E – toluene bath**

The specimen will be left in a backer with water for several hours until a failure, or after 100h  
A visual inspection will be done  
The mass will be measured at last at the begin and at the end of the test.  
The following table will be filled during the test.

DATE	TIME	TEST CONDITION	NOTE

**8.6 TEST F – GE glue (reactivate with toluene) test**

On the specimen will be the GE glue reactivate with toluene, in order to verify the effect of the GE with toluene on the material.  
The mass will be measured at last at the begin and at the end of the test.  
The following table will be filled during the test.

DATE	TIME	TEST CONDITION	NOTE





**Test A**





## 9 TEST SPECIMENS

The specimen used for the test are builded by Officine Pasquali, using Eccosorb CR110 or Eccosorb CR117. The specimens behaves to different batch and were builded in different years.

Specimen Number	Name	Material	Year	Test
1a	Cross @44GHz	ECR110		A
1b	Pyramids @44GHz	ECR110		A
2	Cross @30GHz	ECR110		A
3a	Cross @30GHz	ECR110		B
3b	Cross @44GHz	ECR110		B
4	Sandwich Al6061-ECR110 ECR bonded*	ECR110, Al6061		B
5a	Base @44GHz	ECR117		A
5b	Sandwich Al6061-ECR110 ECR bonded*	ECR110, Al6061		A
6	Cross @30GHz	ECR110		C
7	Base @44GHz	ECR117		B
8	Base @30Ghz	ECR117		B
9	Bulk	ECR110	2004	E
10	Pyramids	ECR110		B
11	Plate	ECR110	2004	C
12	Bulk	ECR110	2004	D
13	Bulk	ECR110	2004	F

\*Specimens builded by IASF





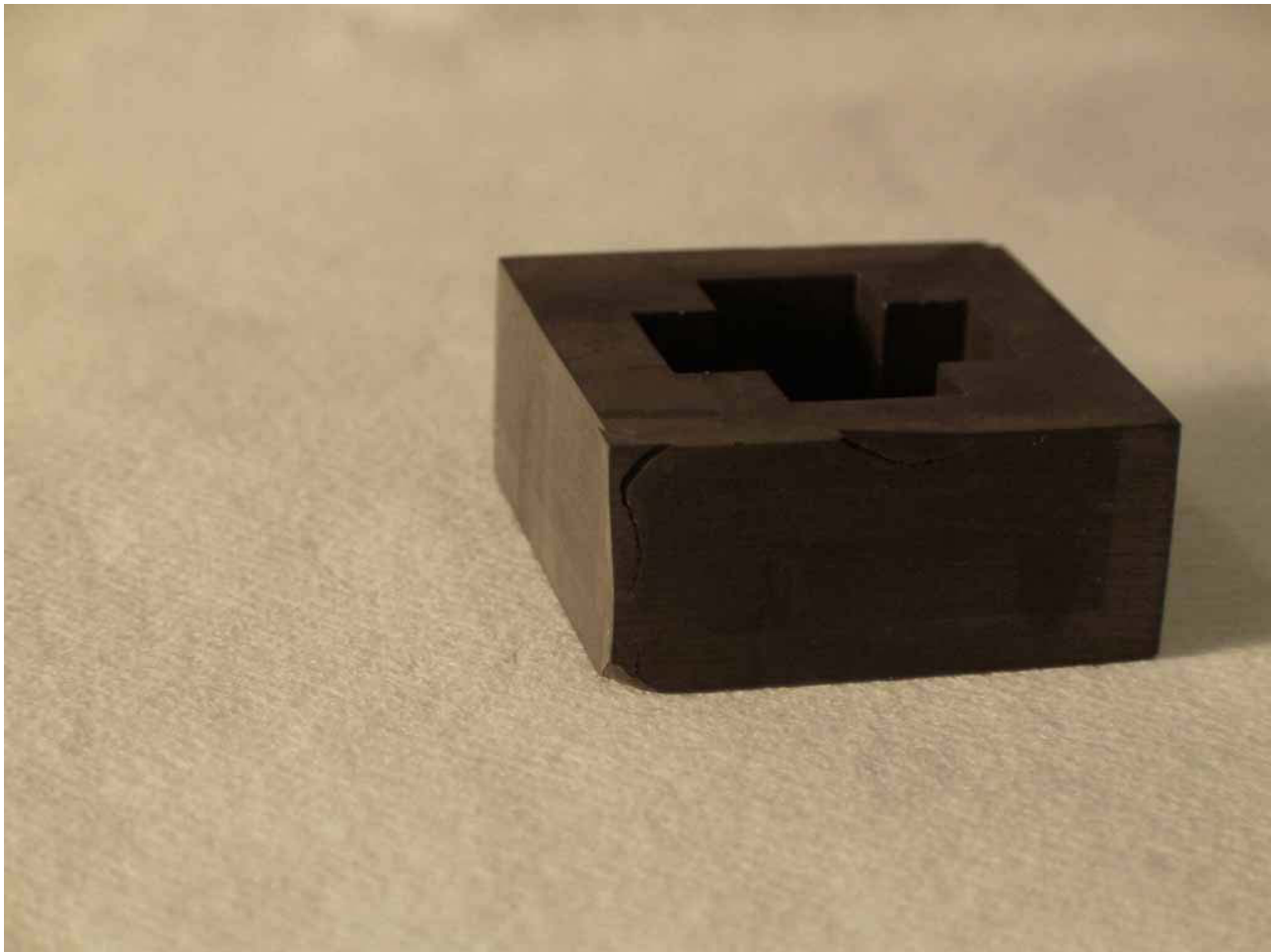


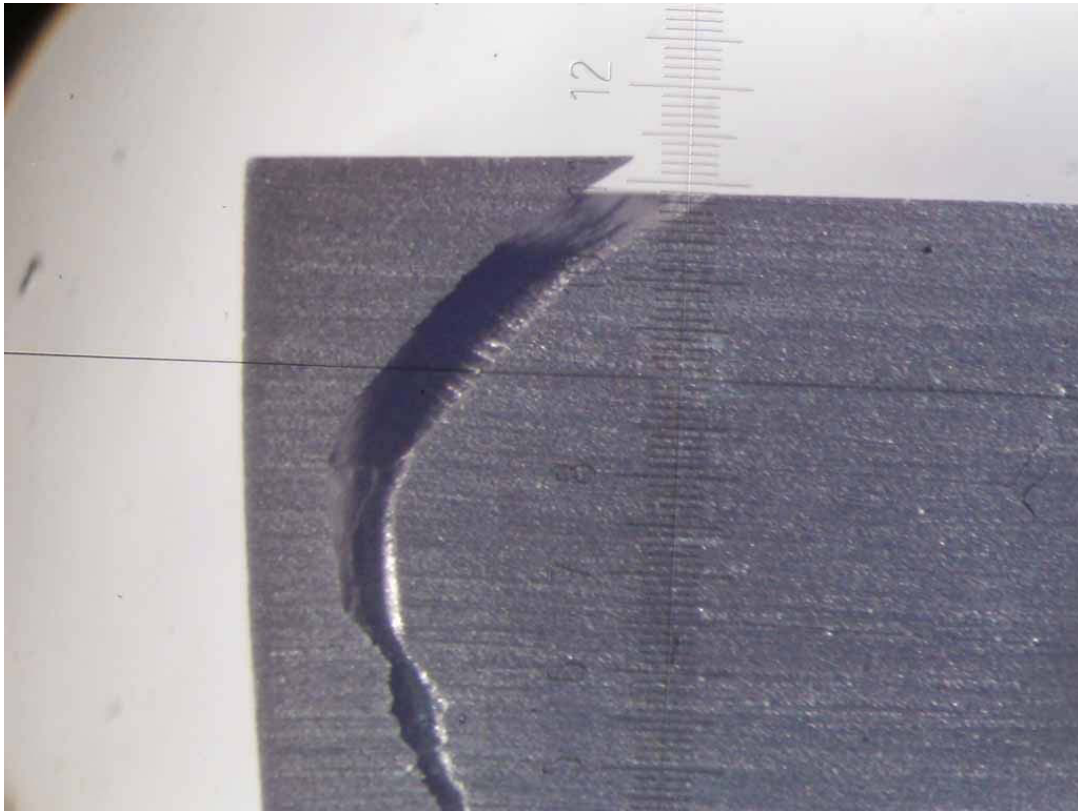
## 10 TEST REPORT

### 10.1 Specimen 1a – Cross @44GHz acetone&ultrasound

DATE	TIME	TEST CONDITION	NOTE
09/03/05	11.00	21.4°C40%HR	<b>Visual Inspection:</b> There are 2 bubble one on the external edge and the other on the internal edge. <b>Mass:</b> 5.7[g]
09/03/05	11.20		<b>Start a battery of 3 cycles of ultrasonic cleaning bath</b>
09/03/05	12.30		<b>End of cycles.</b> <b>Visual Inspection:</b> The specimen has several cracks on all the edge. <b>Mass:</b> 5.7[g]

In the followings images is visible the specimens after all the test.



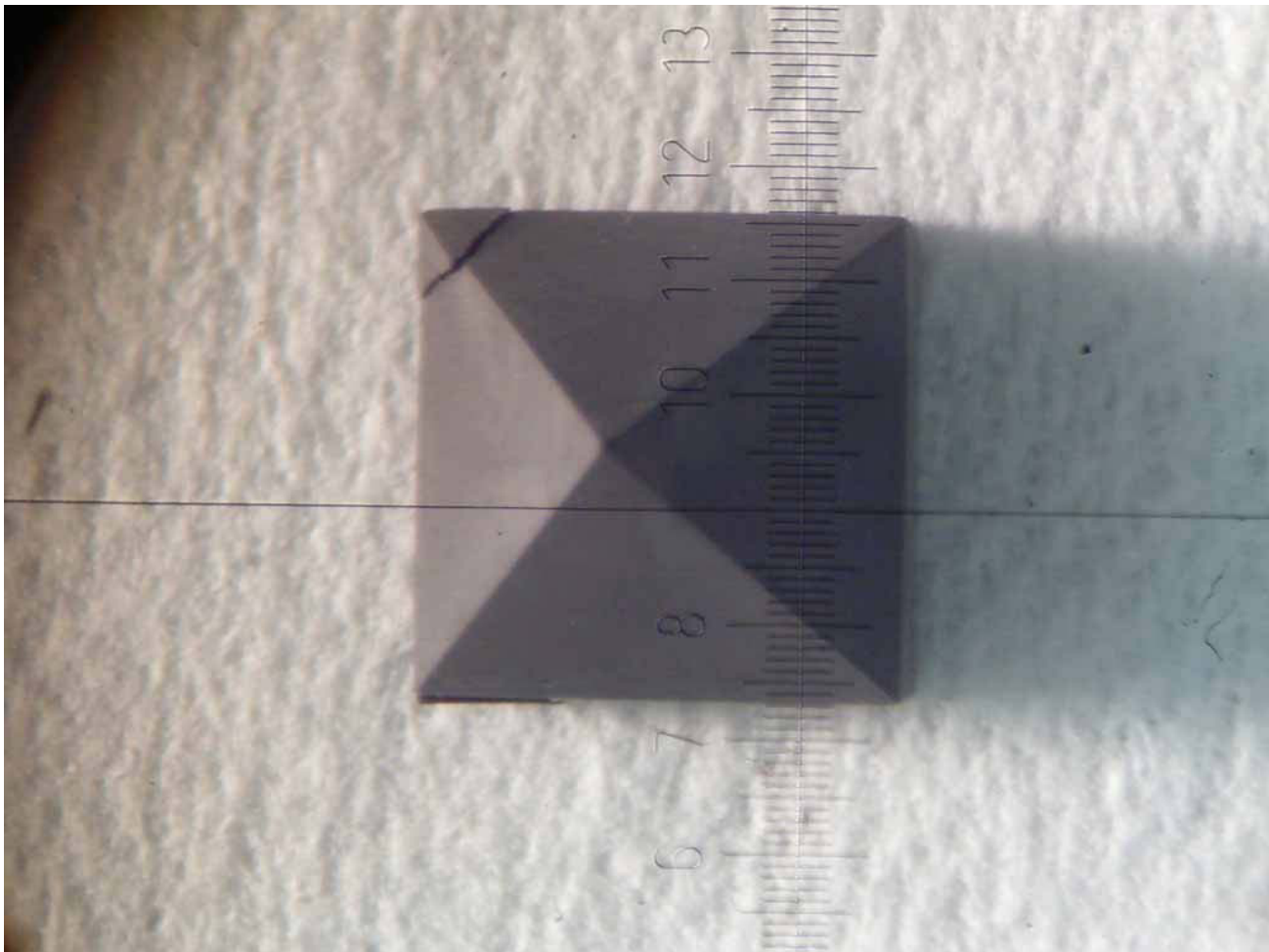


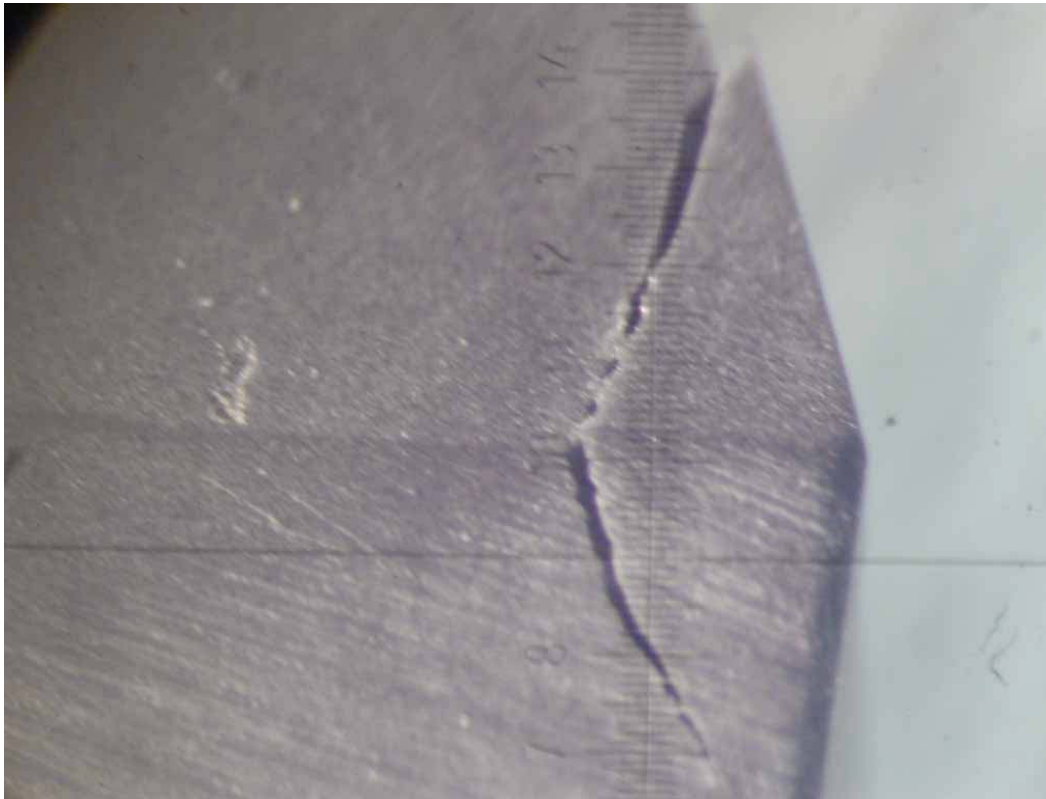


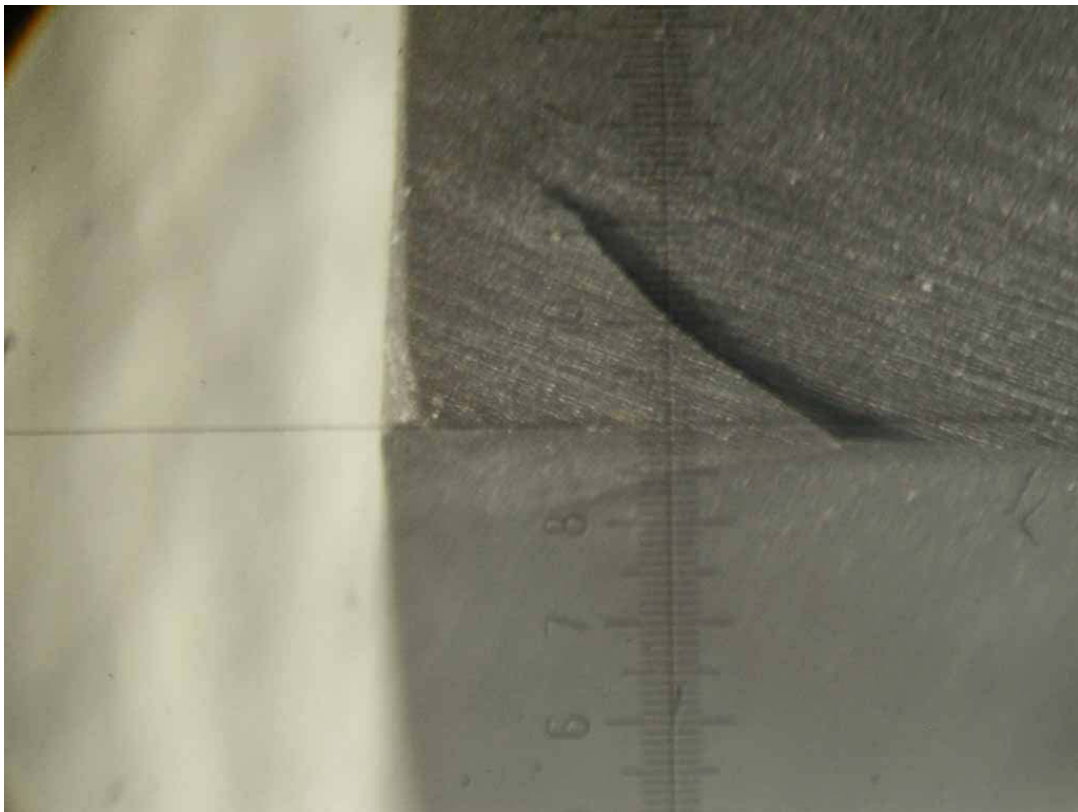
**10.2 Specimen 1b – Pyramids @44GHz acetone&ultrasound**

DATE	TIME	TEST CONDITION	NOTE
09/03/05	11.00	21.4°C40%HR	<b>Visual Inspection:</b> there aren't visible defects <b>Mass:</b> 0.5[g]
09/03/05	11.20		<b>Start a battery of 3 cycles of ultrasonic cleaning bath</b>
09/03/05	12.30		<b>End of cycles.</b> <b>Visual Inspection:</b> The specimen has several cracks on all edges. <b>Mass:</b> 0.5[g]

In the followings images is visible the specimen after all the test





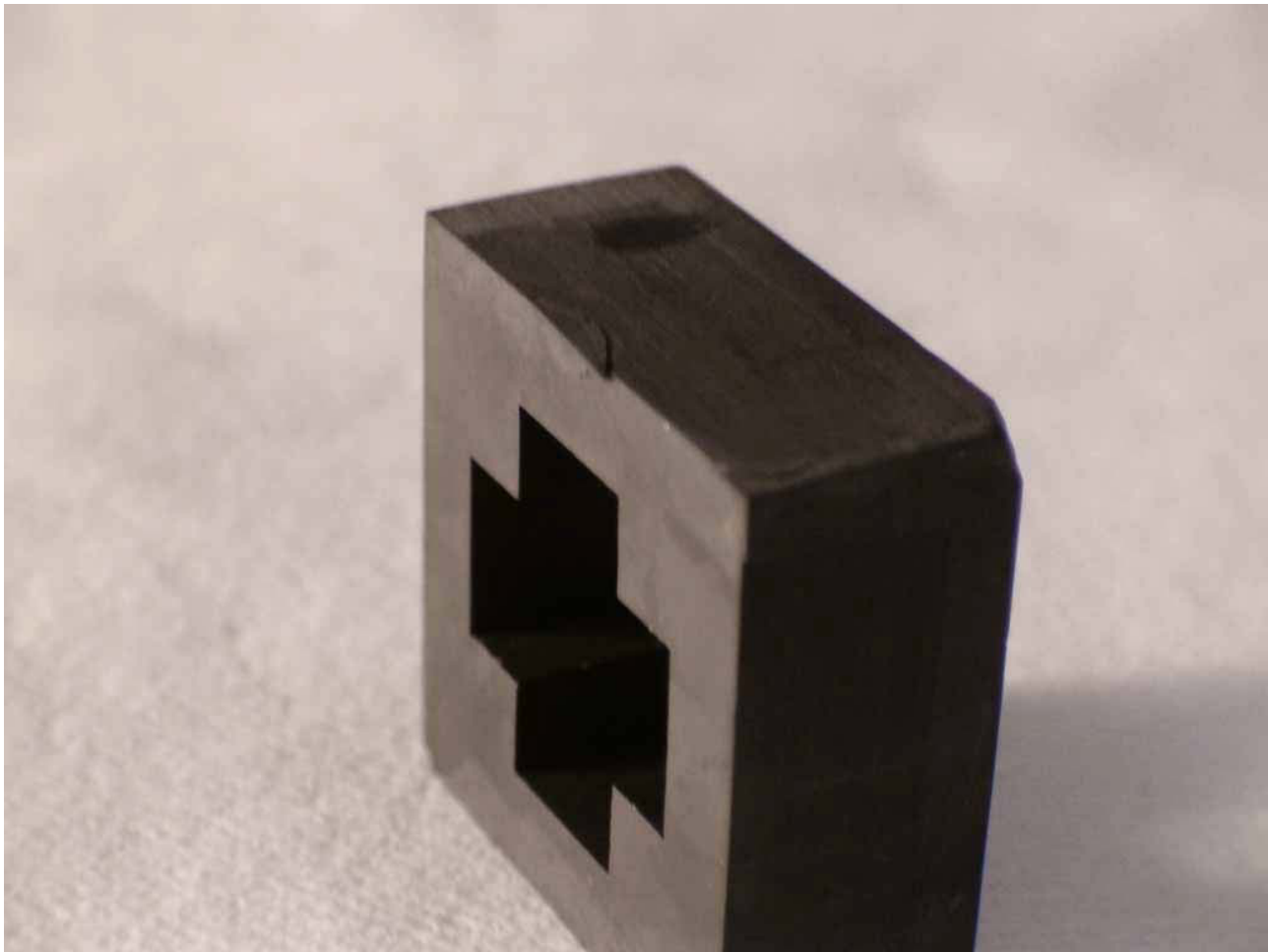


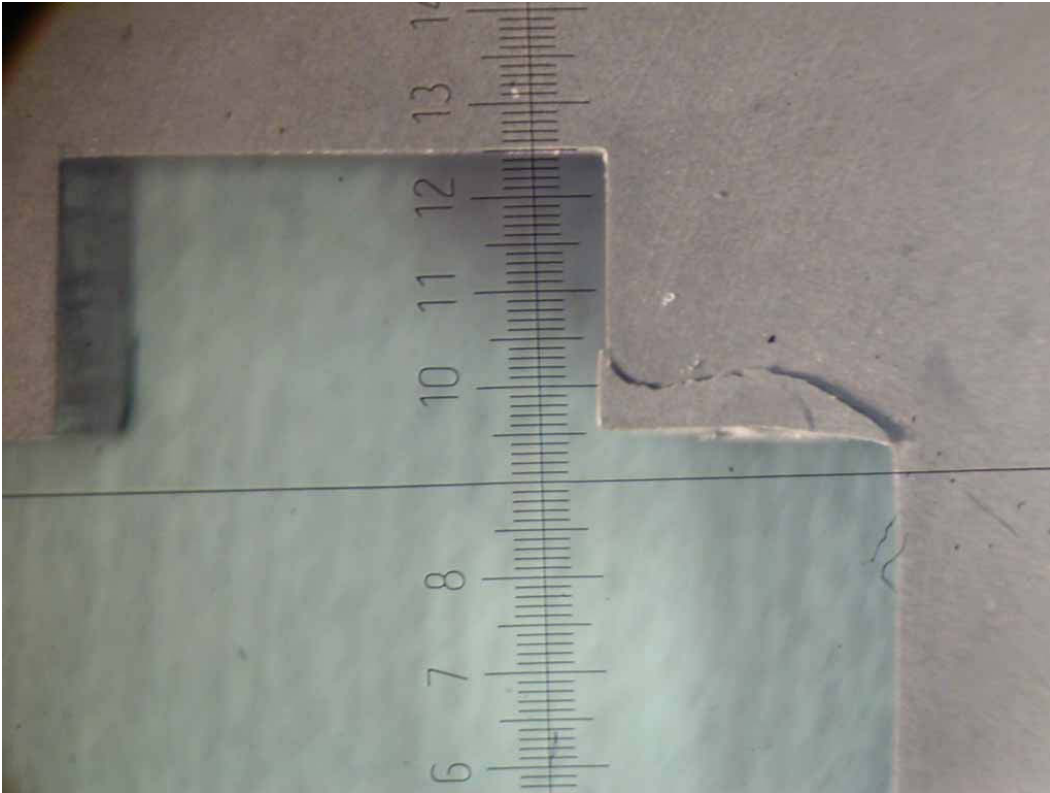
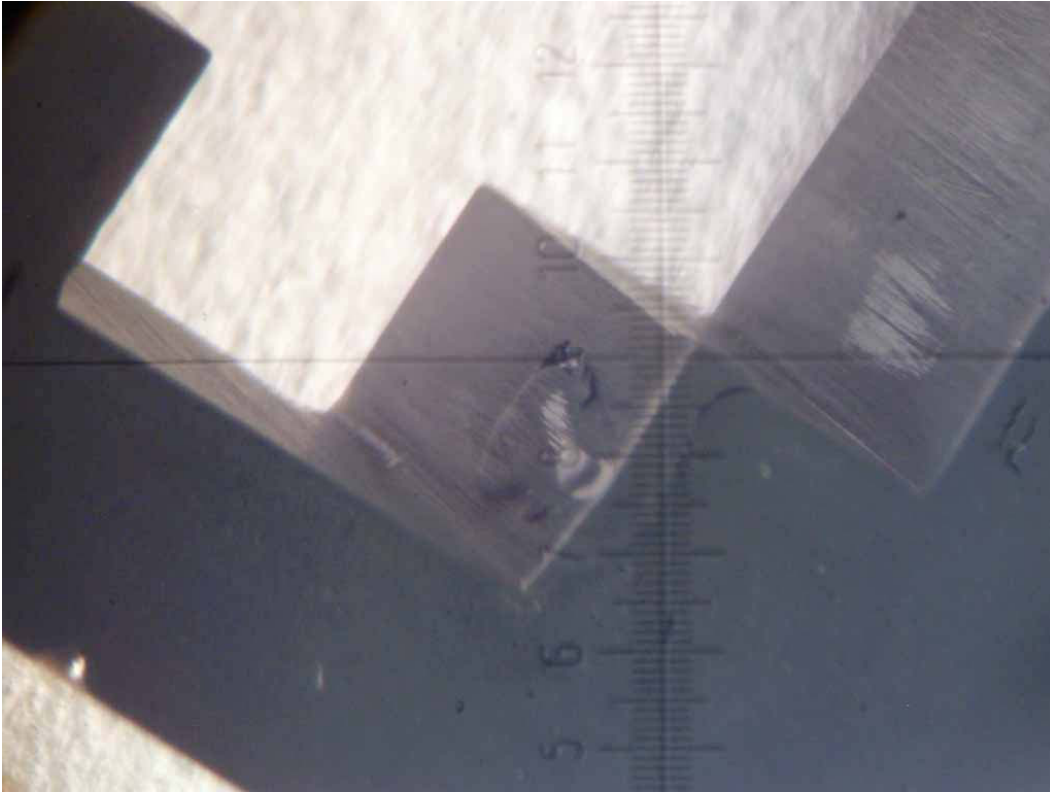


**10.3 Specimen 2 – Cross @30GHz acetone&ultrasound**

DATE	TIME	TEST CONDITION	NOTE
09/03/05	11.00	21.4°C40%HR	<b>Visual Inspection:</b> There are 2 blister on the external edge <b>Mass:</b> 16.5[g]
09/03/05	11.20		<b>Start a sequence of 3 cycles of ultrasonic cleaning bath</b>
09/03/05	12.30		<b>End of the battery of the cycles.</b> <b>Visual Inspection:</b> The specimen doesn't have any crack. <b>Mass:</b> 16.5[g]
09/03/05	16.30	21.6°C40%HR	<b>Start the IV cycle of ultrasonic cleaning bath</b>
09/03/05	17.00		<b>End of the cycle</b> <b>Visual Inspection:</b> There are visible cracks on all the edges

In the followings images is visible the specimen after the IV cycle











### 10.4 Specimen 3a – Cross@30GHz acetone

DATE	TIME	TEST CONDITION	NOTE
09/03/05	11.00	21.4°C40%HR	<b>Visual Inspection:</b> There is a defect on the external edge <b>Mass:</b> 17.9[g]
09/03/05	11.30		<b>The specimen is covered with acetone</b>
09/03/05	14.10		<b>Visual Inspection:</b> there aren't additional visible defects <b>Mass:</b> 17.9[g]
09/03/05	16.40		<b>Visual Inspection:</b> There are visible some white spots.
10/03/05	10.15	21.3°C47%HR	<b>Visual Inspection:</b> There are visible several cracks on all the specimen. It is needed to disrupt the backer to extract the specimen from the backer, since its volumes has increased.

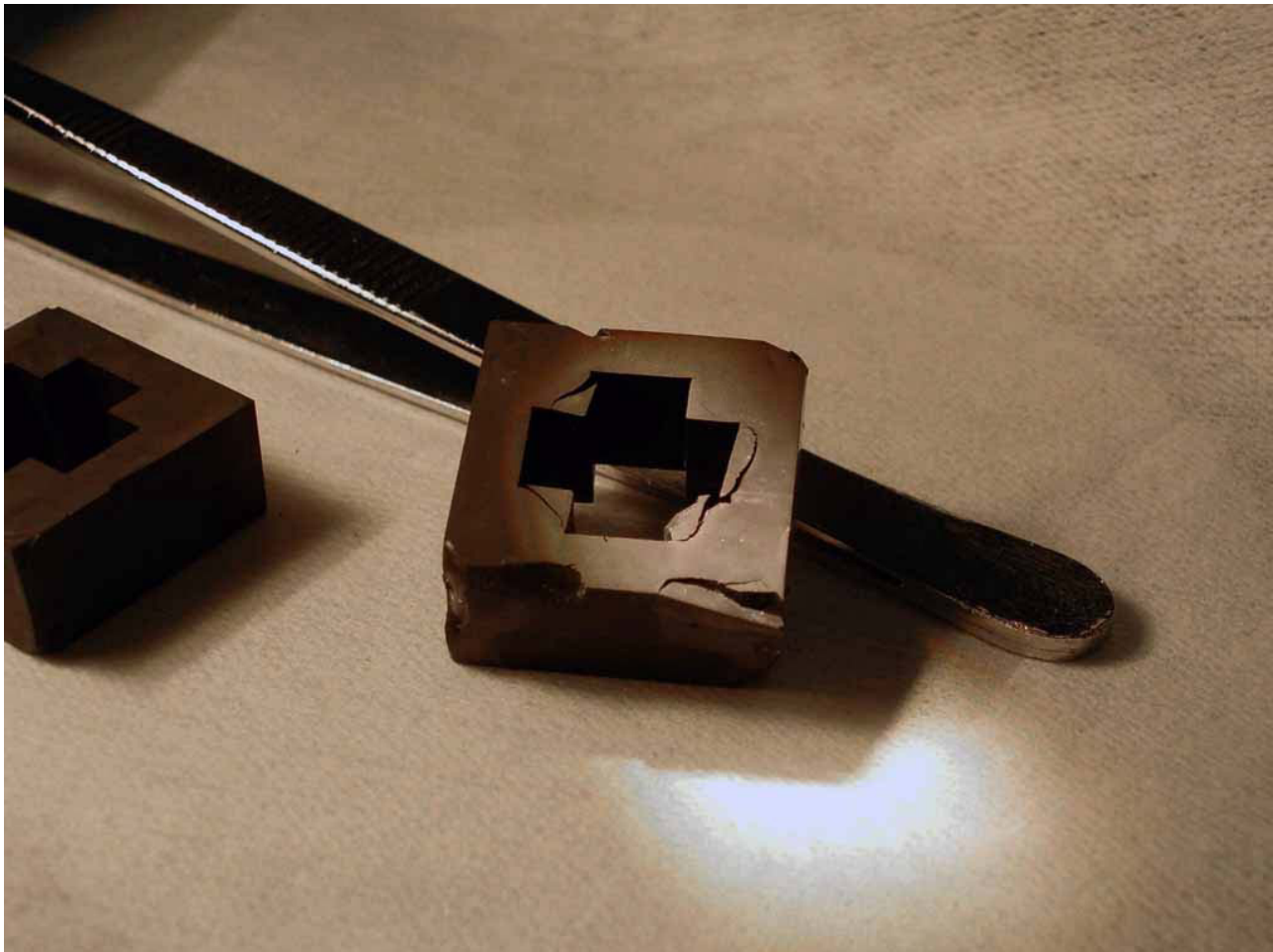


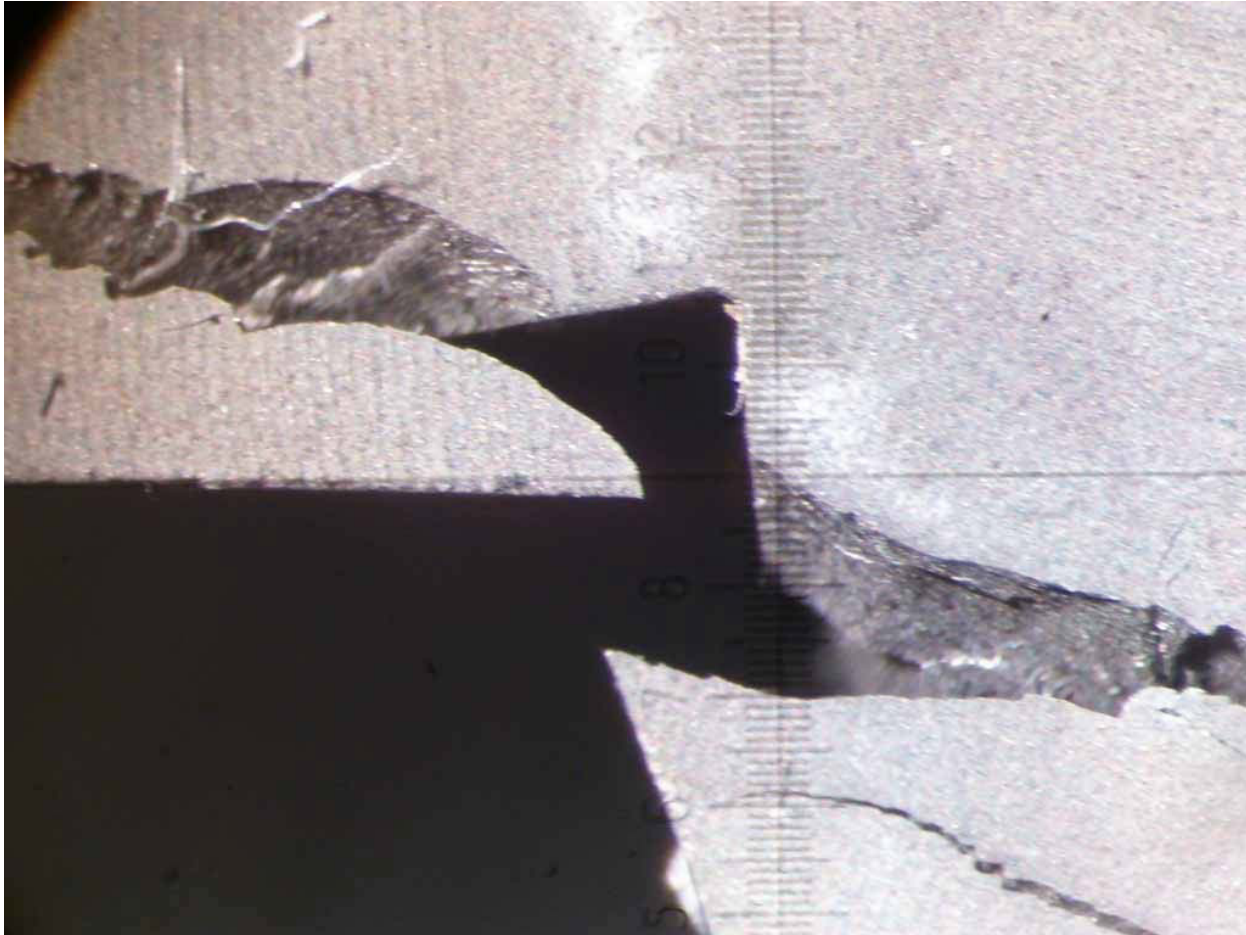




### 10.5 Specimen 3b – Cross@44GHz acetone

DATE	TIME	TEST CONDITION	NOTE
09/03/05	11.00	21.4°C40%HR	<b>Visual Inspection:</b> there aren't visible defects <b>Mass:</b> 5.6[g]
09/03/05	11.30		<b>The specimen is covered with acetone</b>
09/03/05	14.10		<b>Visual Inspection:</b> there aren't visible defects <b>Mass:</b> 5.6[g]
09/03/05	16.40		<b>Visual Inspection:</b> there aren't visible defects
10/03/05	10.15	21.3°C47%HR	<b>Visual Inspection:</b> There are visible several cracks on all the specimen. It is needed to disrupt the backer to extract the specimen from the backer.

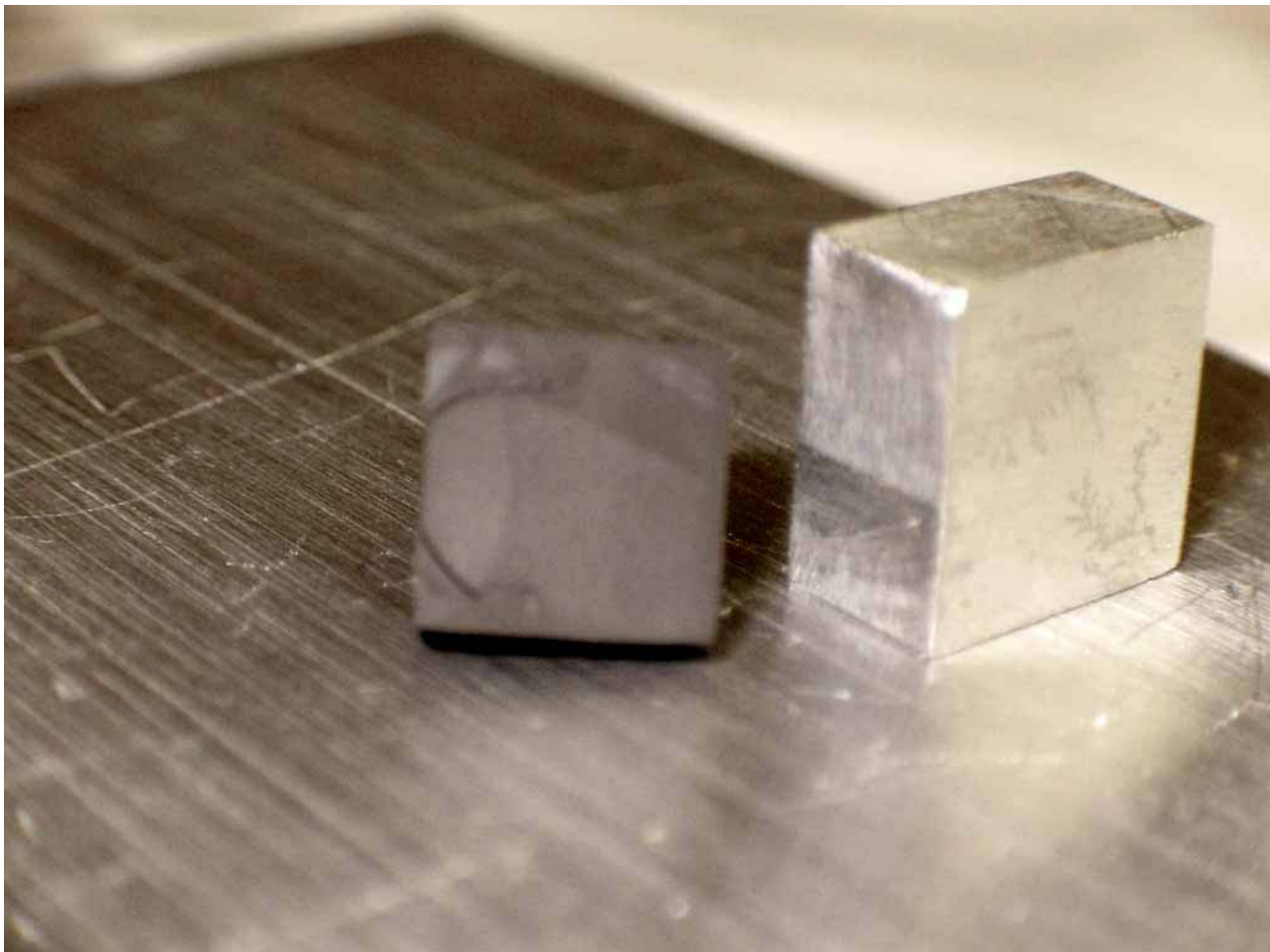






### 10.6 Specimen 4 – Sandwich Al6061-ECR110-ECR bonded acetone

DATE	TIME	TEST CONDITION	NOTE
09/03/05	11.00	21.4°C40%HR	<b>Visual Inspection:</b> There aren't visible defects. <b>Mass:</b> 1.9[g]
09/03/05	11.30		<b>The specimen is covered with acetone</b>
09/03/05	14.10		<b>Visual Inspection:</b> there aren't visible defects <b>Mass:</b> 1.9[g]
09/03/05	16.40		<b>Visual Inspection:</b> there aren't visible defects
10/03/05	10.15	21.3°C47%HR	<b>Visual Inspection:</b> There aren't visible defects on the ECR, but the glueing is broken with a light hand force.



**10.7 Specimen 5a – Base@44GHz acetone&ultrasound**

DATE	TIME	TEST CONDITION	NOTE
09/03/05	11.00	21.4°C40%HR	<b>Visual Inspection:</b> There are visible several blister on 2 edges. <b>Mass:</b> 9.9 [g]
09/03/05	11.20		<b>Start a battery of 3 cycles of ultrasonic cleaning bath</b>
09/03/05	12.30		<b>End of the cycles.</b> <b>Visual Inspection:</b> The specimen doesn't have any crack. <b>Mass:</b> 9.9[g]
09/03/05	17.30	21.6°C40%HR	<b>Start the IV cycle of ultrasonic cleaning bath</b>
09/03/05	17.00		<b>End of the cycle</b> <b>Visual Inspection:</b> There aren't visible cracks on the edges
09/03/05	17.20		<b>Start the V cycle of ultrasonic cleaning bath</b>
09/03/05	17.45		<b>End of the V cycle</b> <b>Visual Inspection:</b> there aren't additional visible defects
10/03/05	16.00	21.3°C47%HR	<b>Start of the VI cycle of ultrasonic cleaning bath</b>
10/03/05	16.25		<b>End of the VI cycle</b> <b>Visual Inspection:</b> there aren't additional visible defects.
10/03/05	16.30		<b>Start of the VII cycle of ultrasonic cleaning bath</b>
10/03/05	16.55		<b>End of the VII cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't additional visible defects.
11/03/05	11.15	21.6°C40%HR	<b>Start of the VIII cycle of ultrasonic cleaning bath</b>
11/03/05	11.40		<b>End of the VIII cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't additional visible defects.
11/03/05	12.05		<b>Start of the IX cycle of ultrasonic cleaning bath</b>
11/03/05	14.05		<b>End of the IX cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't additional visible defects.
11/03/05	14.12		<b>Start of the X cycle of ultrasonic cleaning bath</b>
11/03/05	14.35		<b>End of the X cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't additional visible defects.
11/03/05	14.35		<b>Start of the XI cycle of ultrasonic cleaning bath</b>
11/03/05	15.00		<b>End of the XI cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't additional visible defects.
11/03/05	15.05		<b>Start of the XII cycle of ultrasonic cleaning bath</b>
11/03/05	15.25		<b>End of the XII cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't additional visible defects.
11/03/05	15.30		<b>Start of the XIII cycle of ultrasonic cleaning bath</b>
11/03/05	15.55		<b>End of the XIII cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't additional visible defects.



**10.8 Specimen 5b – Sandwich Al6061-ECR110-ECR bonded acetone&ultrasound**

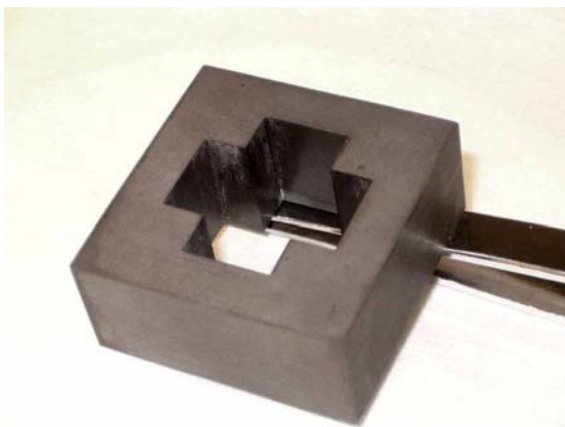
DATE	TIME	TEST CONDITION	NOTE
09/03/05	11.00	21.4°C40%HR	<b>Visual Inspection:</b> There aren't visible defects <b>Mass:</b> 2.1[g]
09/03/05	11.20		<b>Start a battery of 3 cycles of ultrasonic cleaning bath</b>
09/03/05	12.30		<b>End of the battery of test.</b> <b>Visual Inspection:</b> The specimen doesn't have any crack. <b>Mass:</b> 2.1[g]
09/03/05	16.30	21.6°C40%HR	<b>Start a cycle of ultrasonic cleaning bath</b>
09/03/05	17.00		<b>End of the cycle</b> <b>Visual Inspection:</b> There aren't visible cracks on the edges
09/03/05	17.20		<b>Start the V cycle of ultrasonic cleaning bath</b>
09/03/05	17.45		<b>End of the V cycle</b> <b>Visual Inspection:</b> there aren't visible defects
10/03/05	16.00	21.3°C47%HR	<b>Start of the VI cycle of ultrasonic cleaning bath</b>
10/03/05	16.25		<b>End of the VI cycle</b> <b>Visual Inspection:</b> there aren't visible defects.
10/03/05	16.30		<b>Start of the VII cycle of ultrasonic cleaning bath</b>
10/03/05	16.55		<b>End of the VII cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't visible defects.
11/03/05	11.15	21.6°C40%HR	<b>Start of the VIII cycle of ultrasonic cleaning bath</b>
11/03/05	11.40		<b>End of the VIII cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't visible defects.
11/03/05	12.05		<b>Start of the IX cycle of ultrasonic cleaning bath</b>
11/03/05	14.05		<b>End of the IX cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't visible defects.
11/03/05	14.12		<b>Start of the X cycle of ultrasonic cleaning bath</b>
11/03/05	14.35		<b>End of the X cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't visible defects.
11/03/05	14.35		<b>Start of the XI cycle of ultrasonic cleaning bath</b>
11/03/05	15.00		<b>End of the XI cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't visible defects.
11/03/05	15.05		<b>Start of the XII cycle of ultrasonic cleaning bath</b>
11/03/05	15.25		<b>End of the XII cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't visible defects.
11/03/05	15.30		<b>Start of the XIII cycle of ultrasonic cleaning bath</b>
11/03/05	15.55		<b>End of the XIII cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't visible defects.





### 10.9 Specimen 6 – Cross@30GHz, water&ultrasound

DATE	TIME	TEST CONDITION	NOTE
10/03/05	15.00	21.3°C47%HR	<b>Visual Inspection:</b> There is a long crack on one of the internal edges. <b>Mass:</b> 18.28 [g]
10/03/05	16.00		<b>Start of the I cycle of ultrasonic cleaning bath</b>
10/03/05	16.25		<b>End of the cycle</b> <b>Visual Inspection:</b> there aren't additional visible defects.
10/03/05	16.30		<b>Start of the II cycle of ultrasonic cleaning bath</b>
10/03/05	16.55		<b>End of the II cycle</b> <b>Visual Inspection:</b> there aren't additional visible defects.
11/03/05	11.15	21.6°C40%HR	<b>Start of the III cycle of ultrasonic cleaning bath</b>
11/03/05	11.40		<b>End of the III cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't additional visible defects.
11/03/05	12.05		<b>Start of the IV cycle of ultrasonic cleaning bath</b>
11/03/05	14.05		<b>End of the IV cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't additional visible defects.
11/03/05	14.12		<b>Start of the V cycle of ultrasonic cleaning bath</b>
11/03/05	14.35		<b>End of the V cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't additional visible defects.
11/03/05	14.35		<b>Start of the VI cycle of ultrasonic cleaning bath</b>
11/03/05	15.00		<b>End of the VI cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't additional visible defects.
11/03/05	15.05		<b>Start of the VII cycle of ultrasonic cleaning bath</b>
11/03/05	15.25		<b>End of the VII cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't additional visible defects.
11/03/05	15.30		<b>Start of the VIII cycle of ultrasonic cleaning bath</b>
11/03/05	15.55		<b>End of the VIII cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't additional visible defects.



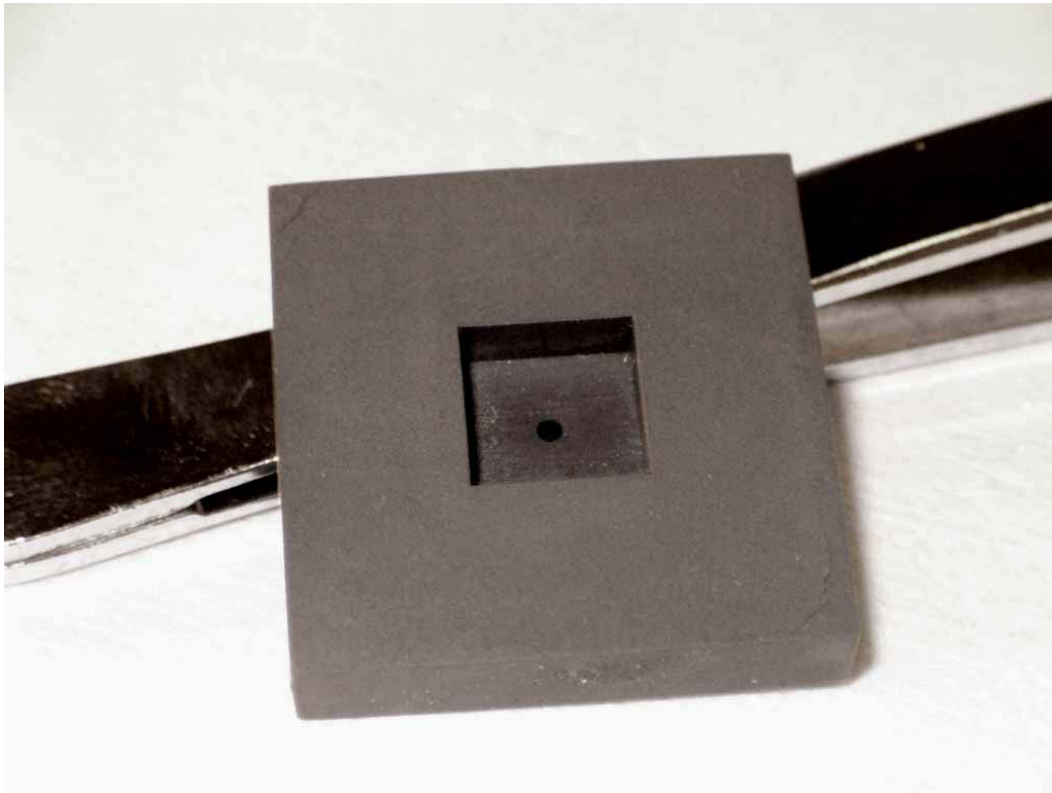




### 10.10 Specimen 7 – base@44GHz acetone

DATE	TIME	TEST CONDITION	NOTE
09/03/05	11.00	21.4°C40%HR	<b>Visual Inspection:</b> There aren't visible defects <b>Mass:</b> 9.3[g]
09/03/05	11.30		<b>The specimen is covered with acetone</b>
09/03/05	14.10		<b>Visual Inspection:</b> there aren't visible defects <b>Mass:</b> 9.3[g]
09/03/05	16.40		<b>Visual Inspection:</b> there aren't visible defects
10/03/05	10.15	21.3°C47%HR	<b>Visual Inspection:</b> There aren't visible defects. <b>Mass:</b> 9.7[g]
10/03/05	16.50		<b>Visual Inspection:</b> there aren't visible defects
11/03/05	11.00		<b>Visual Inspection:</b> there aren't visible defects <b>Mass:</b> 9.79 [g]
11/03/05	14.12		<b>Visual Inspection:</b> there aren't visible defects
11/03/05	16.00		<b>Visual Inspection:</b> there aren't visible defects
14/03/05	9.50		<b>Visual Inspection:</b> the acetone is evaporated and there is a viscous liquid on the surface and it is easy to scratch. <b>Mass:</b> 9.83 [g]
14/03/05	15.20		<b>Visual Inspection:</b> there aren't visible defects
15/03/05	10.00	21.5°C40.3%HR	<b>Visual Inspection:</b> there aren't visible defects, but it is possible to crack it with a light hand pressure. <b>Mass:</b> 9.92 [g]
15/03/05	15.30		<b>Mass:</b> 9.88 [g]





**10.11 Specimen 8 – base@30GHz acetone**

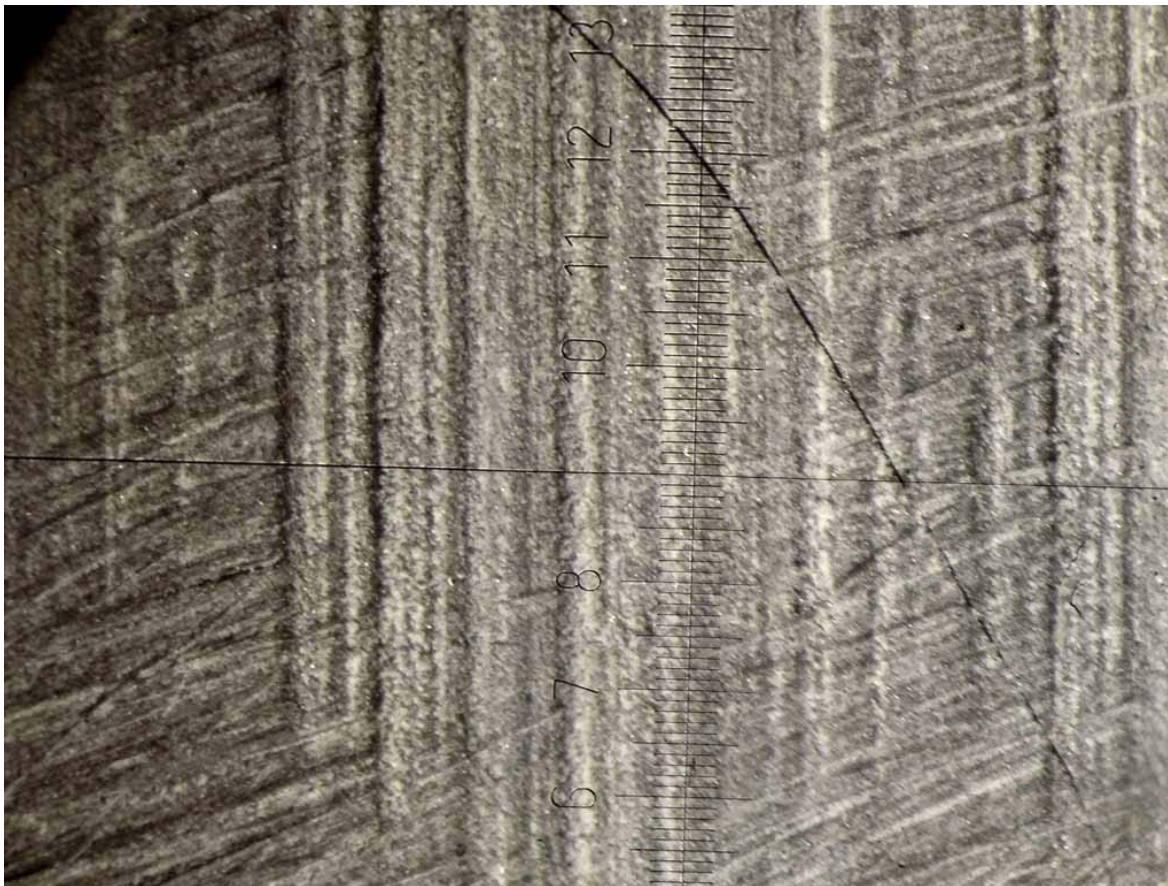
DATE	TIME	TEST CONDITION	NOTE
09/03/05	11.00	21.4°C40%HR	<b>Visual Inspection:</b> There aren't visible defects <b>Mass:</b> 21.0[g]
09/03/05	11.30		<b>The specimen is covered with acetone</b>
09/03/05	14.10		<b>Visual Inspection:</b> there aren't visible defects <b>Mass:</b> 21.0[g]
09/03/05	16.40		<b>Visual Inspection:</b> there aren't visible defects
10/03/05	10.15	21.3°C47%HR	<b>Visual Inspection:</b> There aren't visible defects, but with a light hand pressure it is possible to crack the more thin part of the specimen. <b>Mass:</b> 20.9[g]



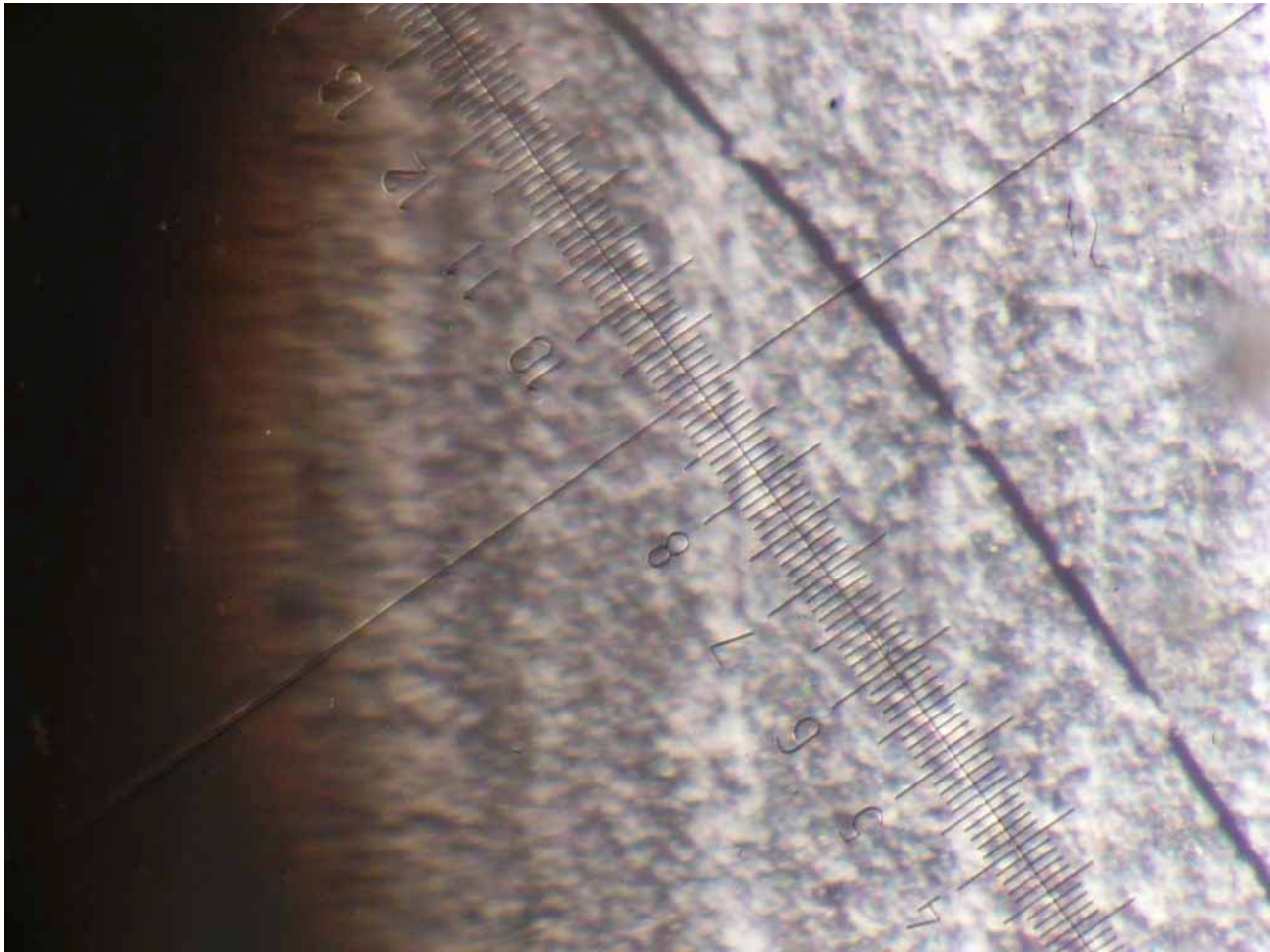


**10.12 Specimen 9 – bulk toluene**

DATE	TIME	TEST CONDITION	NOTE
15/03/05	15.30	22.9°C38.7HR	<b>Visual Inspection:</b> the specimen has the lateral surfaces lumpy <b>The specimen is partially covered with toluene</b>
16/03/05	9.55		<b>Visual Inspection:</b> there is a log crack.









### 10.13 Specimen 10 – Pyramid acetone

DATE	TIME	TEST CONDITION	NOTE
09/03/05	11.00	21.4°C40%HR	<b>Visual Inspection:</b> There aren't visible defects <b>Mass:</b> 1.9[g]
09/03/05	11.30		<b>The specimen is covered with acetone</b>
09/03/05	14.10		<b>Visual Inspection:</b> there aren't visible defects <b>Mass:</b> 1.9[g]
09/03/05	16.40		<b>Visual Inspection:</b> there aren't visible defects
10/03/05	10.15	21.3°C47%HR	<b>Visual Inspection:</b> There aren't visible defects
10/03/05	16.50		<b>Visual Inspection:</b> there aren't visible defects
11/03/05	11.00		<b>Visual Inspection:</b> there aren't visible defects <b>Mass:</b> 1.94 [g]
11/03/05	14.12		<b>Visual Inspection:</b> there aren't visible defects
11/03/05	16.00		<b>Visual Inspection:</b> there aren't visible defects
14/03/05	9.50		<b>Visual Inspection:</b> there aren't visible defects. The acetone is evaporated. <b>Mass:</b> 1.94 [g]
14/03/05	15.20		<b>Visual Inspection:</b> there aren't visible defects
15/03/05	10.00	21.5°C40.3%HR	<b>Visual Inspection:</b> there aren't visible defects. <b>Mass:</b> 1.95 [g]



**10.14 Specimen 11 – Plate water&ultrasound**

DATE	TIME	TEST CONDITION	NOTE
10/03/05	15.00	21.3°C47%HR	<b>Visual Inspection:</b> There aren't visible defects. <b>Mass:</b> [g]
10/03/05	16.00		<b>Start of the I cycle of ultrasonic cleaning bath</b>
10/03/05	16.25		<b>End of the cycle</b> <b>Visual Inspection:</b> there aren't visible defects.
10/03/05	16.30		<b>Start of the II cycle of ultrasonic cleaning bath</b>
10/03/05	16.55		<b>End of the II cycle</b> <b>Visual Inspection:</b> there aren't visible defects.
11/03/05	11.15	21.6°C40%HR	<b>Start of the III cycle of ultrasonic cleaning bath</b>
11/03/05	11.40		<b>End of the III cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't visible defects.
11/03/05	12.05		<b>Start of the IV cycle of ultrasonic cleaning bath</b>
11/03/05	14.05		<b>End of the IV cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't visible defects.
11/03/05	14.12		<b>Start of the V cycle of ultrasonic cleaning bath</b>
11/03/05	14.35		<b>End of the V cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't visible defects.
11/03/05	14.35		<b>Start of the VI cycle of ultrasonic cleaning bath</b>
11/03/05	15.00		<b>End of the VI cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't visible defects.
11/03/05	15.05		<b>Start of the VII cycle of ultrasonic cleaning bath</b>
11/03/05	15.25		<b>End of the VII cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't visible defects.
11/03/05	15.30		<b>Start of the VIII cycle of ultrasonic cleaning bath</b>
11/03/05	15.55		<b>End of the VIII cycle of ultrasonic cleaning bath</b> <b>Visual inspection:</b> there aren't visible defects.





### 10.15 Specimen 12 – Bulk water

DATE	TIME	TEST CONDITION	NOTE
10/03/05	14.30	21.3°C47%HR	<b>Visual Inspection:</b> there aren't visible defects <b>Mass:</b> 53.71 [g]
10/03/05	16.50		<b>Visual Inspection:</b> there aren't visible defects
11/03/05	11.00		<b>Visual Inspection:</b> there aren't visible defects <b>Mass:</b>
11/03/05	14.12		<b>Visual Inspection:</b> there aren't visible defects
11/03/05	16.00		<b>Visual Inspection:</b> there aren't visible defects
14/03/05	9.50		<b>Visual Inspection:</b> there aren't visible defects <b>Mass:</b> 53.75 [g]
14/03/05	15.20		<b>Visual Inspection:</b> there aren't visible defects



**10.16 Specimen 13 – Bulk GE glue reactivated**

DATE	TIME	TEST CONDITION	NOTE
15/03/05	15.30		The specimen is partially covered with GE glue reactivated with toluene.
16/03/05	9.55		<b>Visual Inspection:</b> there aren't visible defects.
17/03/05	14.00		<b>Visual Inspection:</b> there aren't visible defects.
18/03/05	12.10		<b>Visual Inspection:</b> there aren't visible defects.
21/03/05	15.00		<b>Visual Inspection:</b> there aren't visible defects.



