Kapton Pyrolisis on Space Station Freedom's Solar Array Flexible Current Carrier

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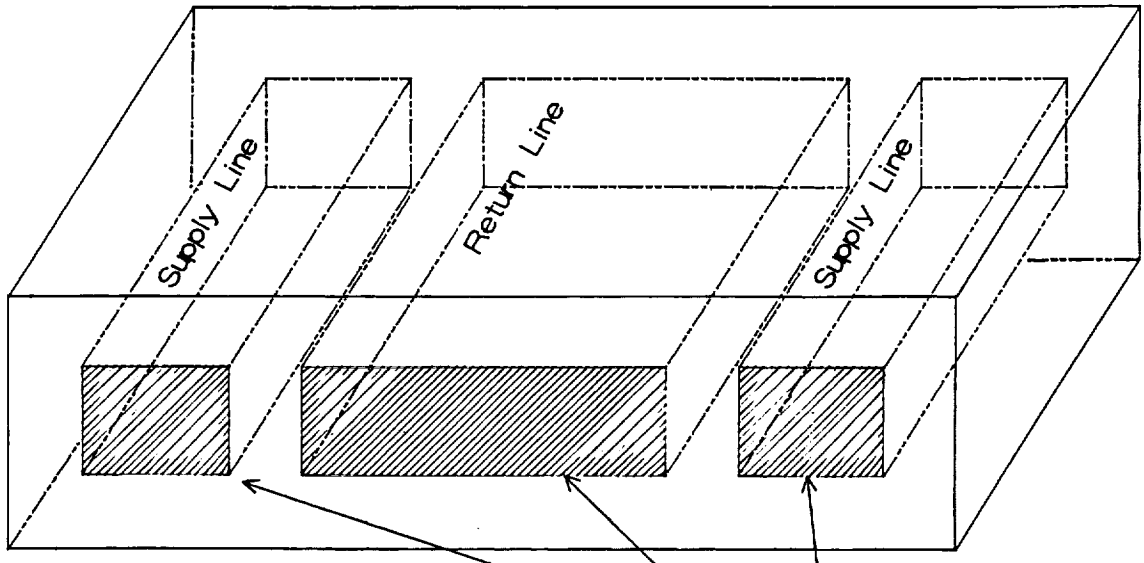
Objectives:

* **Investigate possible events that could cause the kapton to pyrolize.**

* **Investigate the degree of damage when the kapton pyrolizes.**

.07" spacing between copper conductors



Supply Line => .097" x .0059"
Return Line => .164" x .0059"

One Channel Sample FCC

Simulation of possible causes of FCC Kapton Pyrolysis in LEO:

* **Leo space plasma interaction.**

* **micro-meteoroid or debree impact.**

  - Local plasma created by energetic debree or micro_meteoroid impacts. (capacitive).
  - Local plasma generation when conductor breaks (inductive).

* **Momentary current carrier shorts.**

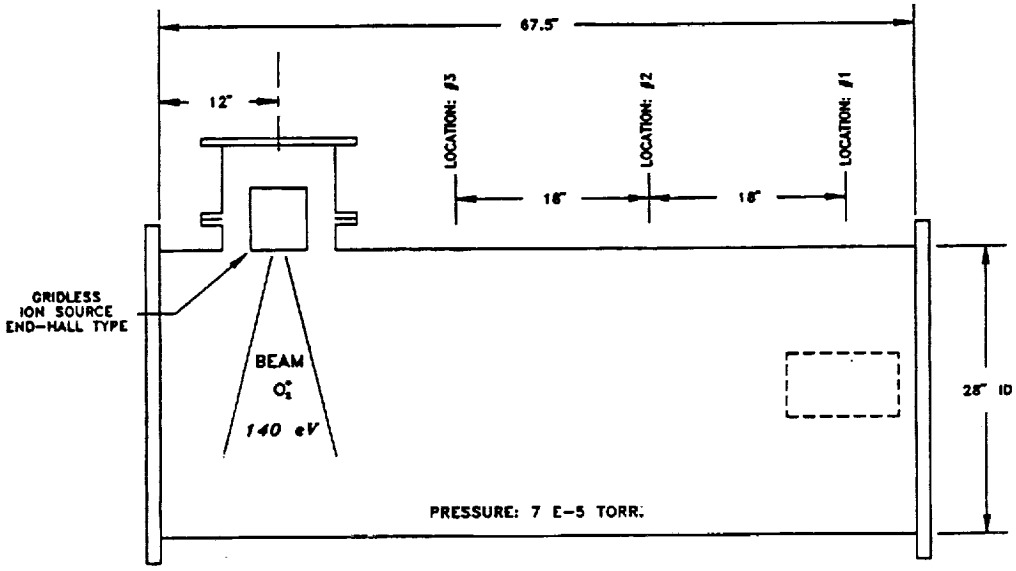
  - Micro-meteoroid and debree impacts
  - Extension and retraction of atomic oxygen eroded Kapton.

Possible Causes:

LEO SPACE PLASMA

INTERACTION.

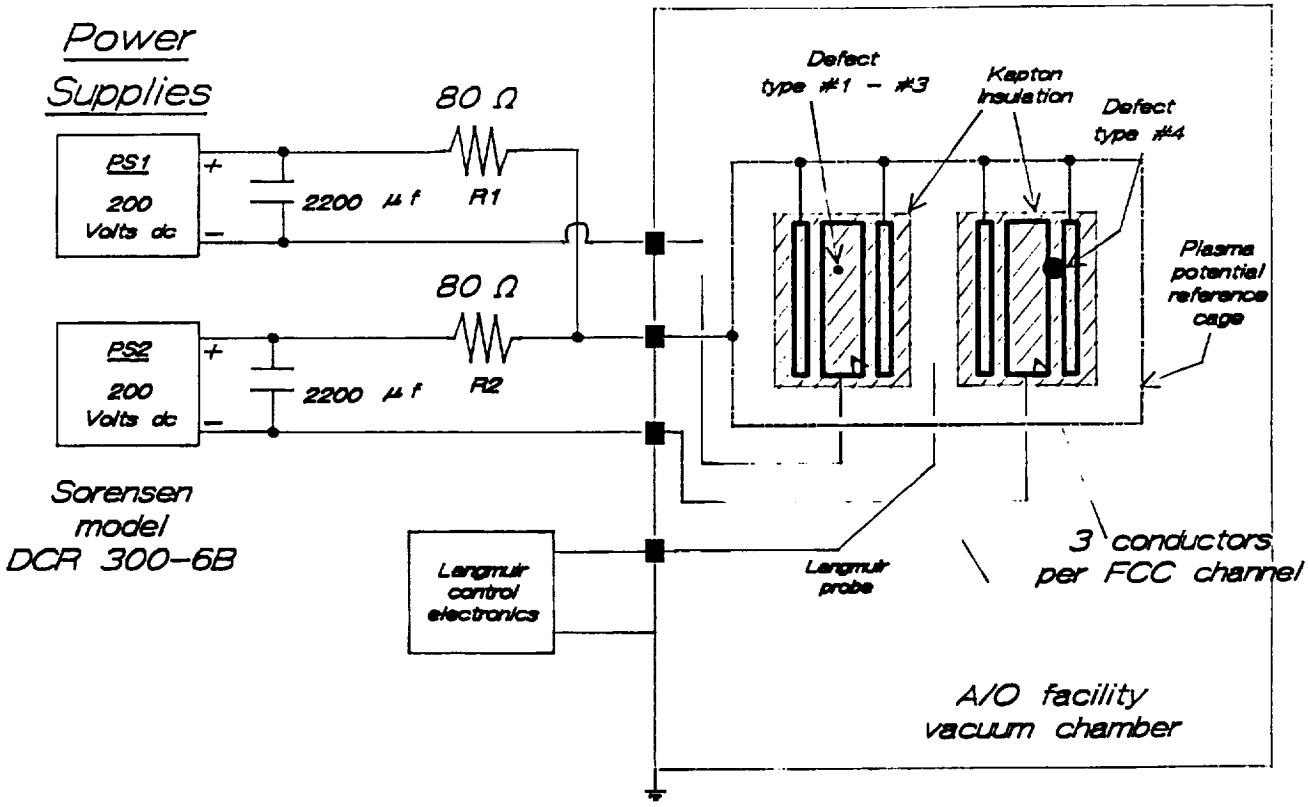
TEST POSITION IN THE LeRC A/O FACILITY OXYGEN PLASMA ENVIRONMENT



PYROLIZATION TEST PLASMA DATA

DATE 1990	Run No.	KT_e/e (eV)	n_i (#/cm^3)	j_e (mA/cm^2)	j_i (mA/cm^2)	Plasma Potential (V)	Floating Potential (V)
12/5	1	3.7	4.3 E7	.22	2.3 E-3	15	-6.5
12/6	1	4.8	4.1 E7	.24	2.5 E-3	23	-9.0
12/6	2	3.5	6.8 E7	.35	3.5 E-3	19.5	-6.0

Oxygen Plasma Environment (O_2^+)



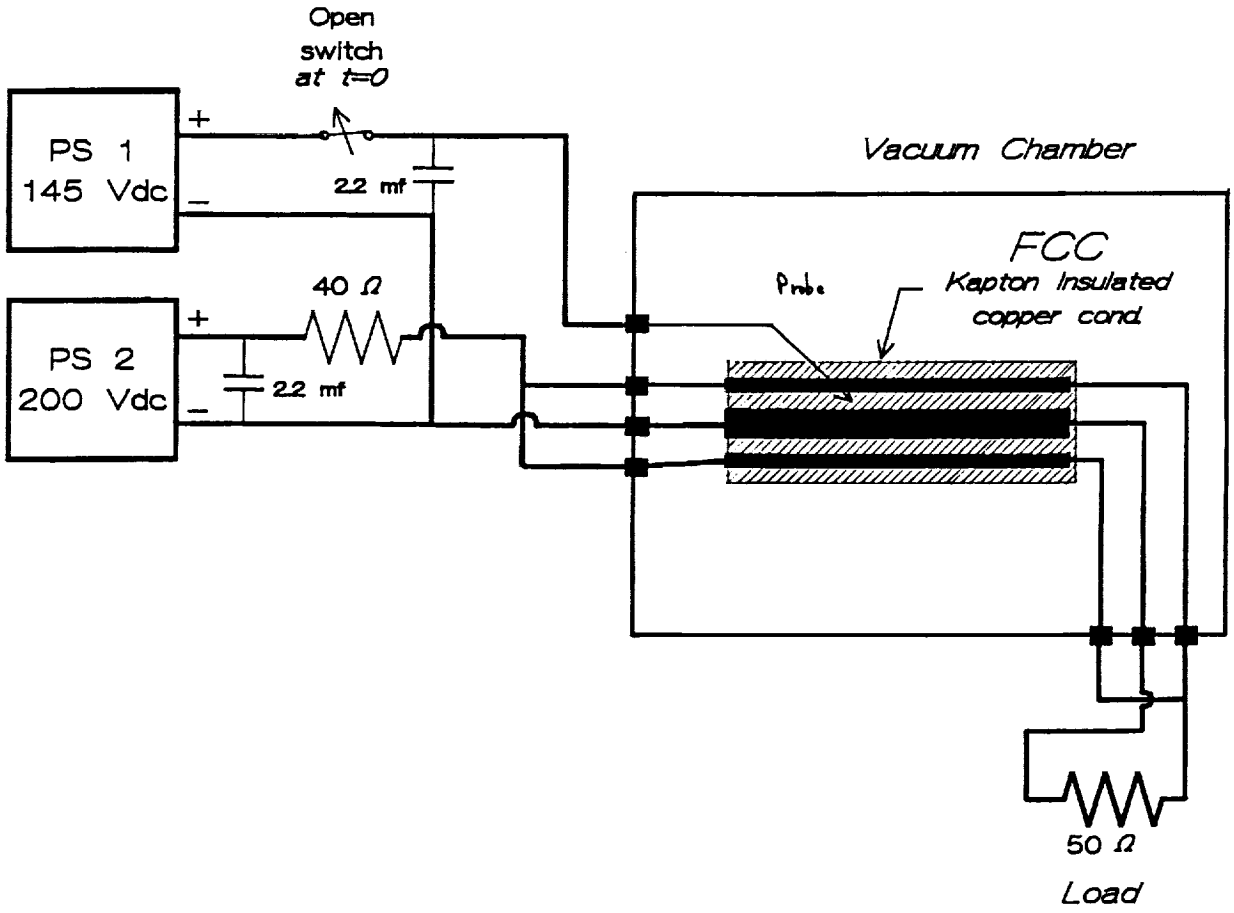
Results:

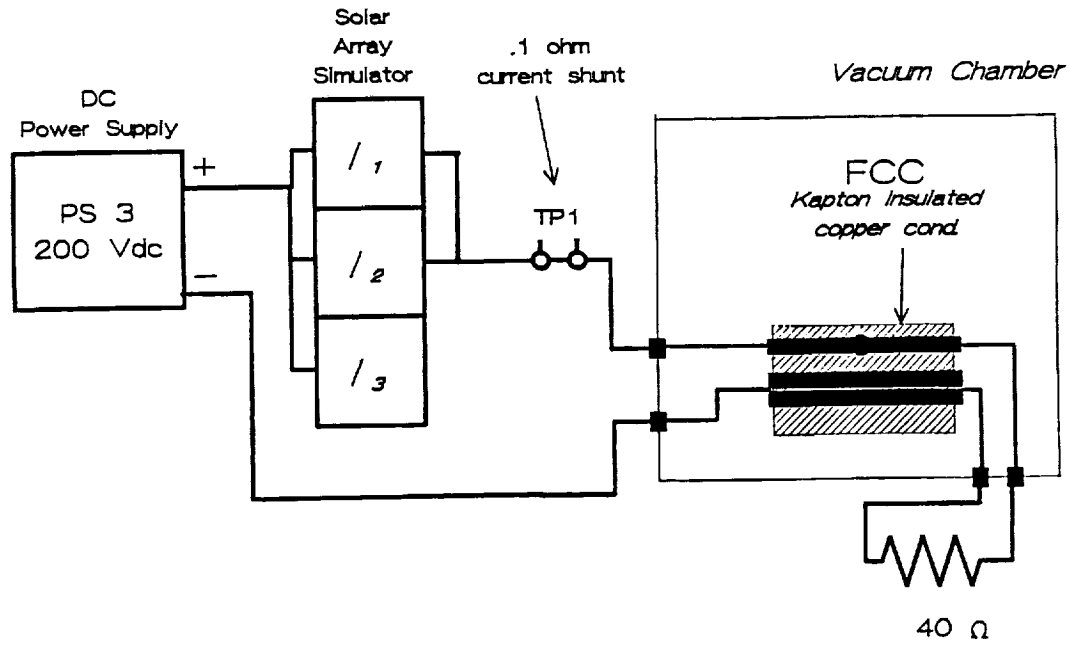
* **No destructive arcing occurred on FCC.**
* **No visual damage to FCC as a result of test.**

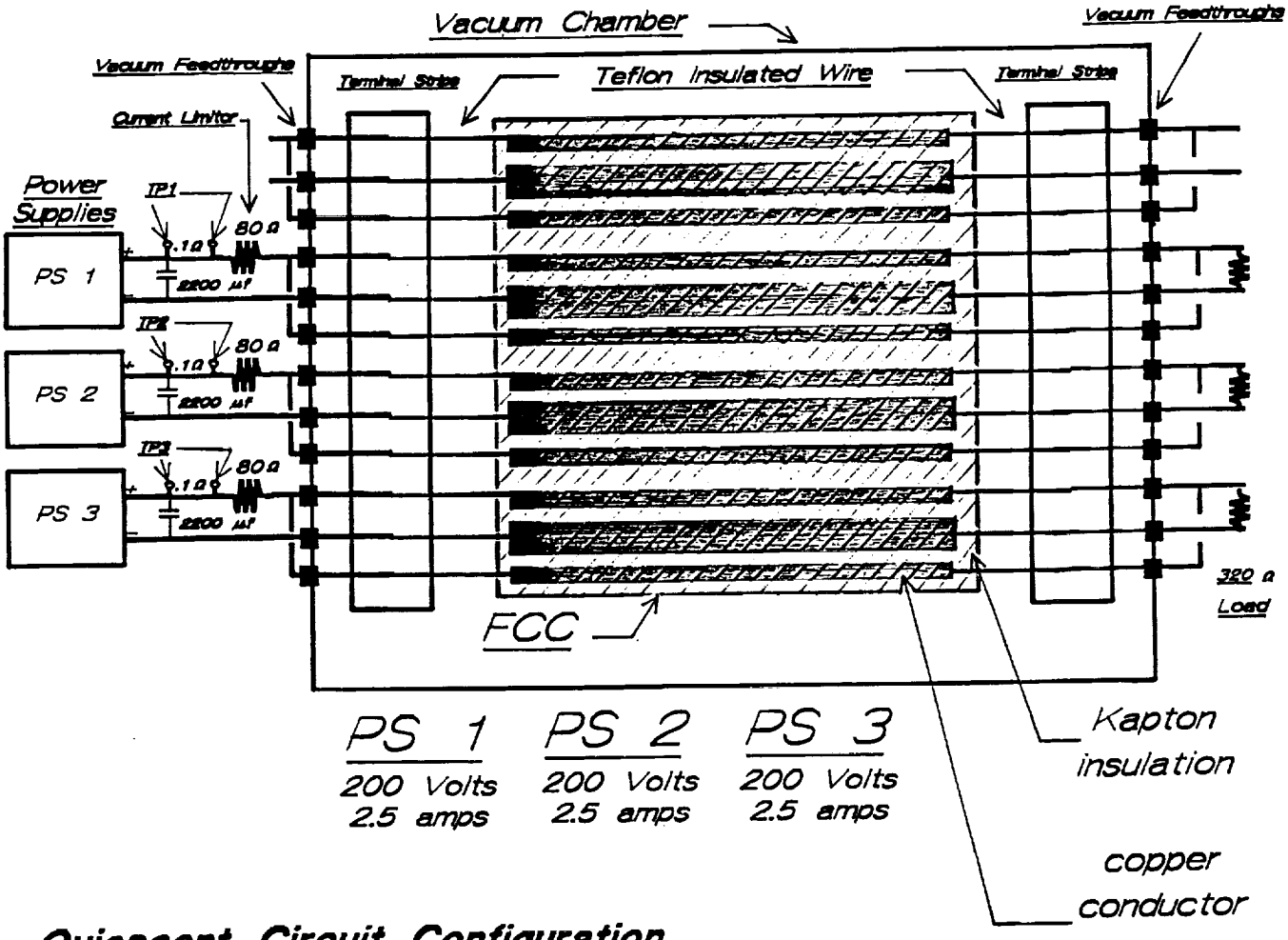
Possible Cause:

MICRO-METEOROID or

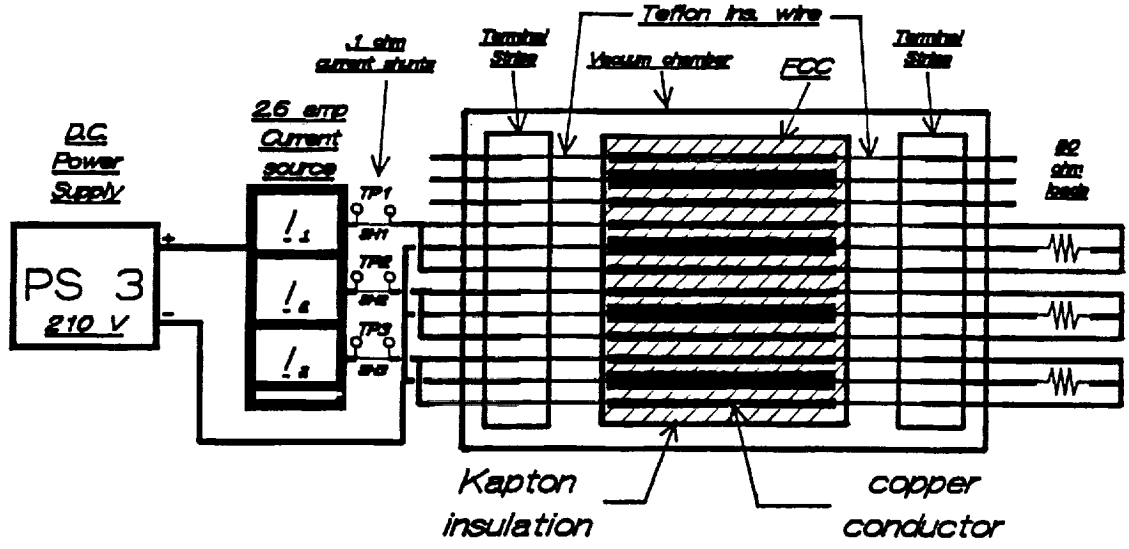
DEBREE IMPACTS.







Quiescent Circuit Configuration.



Solar Array Simulator Circuit configuration.

MOMENTARY CURRENT CARRIER SHORTS:

* **INVESTIGATION OF EVENTS CAUSING PYROLYSIS.**

* **DAMAGE ASSESSMENT**

Test #7

Objective:

Identify, the threshold power to initiate the Kapton pyrolysis event.

Circuit:

Quiescent circuit configuration.

Procedure:

Only one channel energized.

Voltage incremented from 0 to 200 Vdc.

Create a short circuit at each voltage increment.

Results:

Pyrolysis and arc tracking initiated when the voltage was set at 145 volts dc.

Only 90 volts was necessary to restart arc tracking event.

History of sparks at the defect site seemed to be contributing factors.

Test #8

Objective:

Identify Power requirements for Kapton pyrolysis.

Circuit:

Solar Array circuit configuration.

Procedure:

Only one channel energized.

Current incremented from 0 to 2.5 amps.

Create an arc at the defect site after each increment in current.

Results:

Pyrolysis, and arc tracking experienced at 2 amps.

Test #9

Objective:

Identify power necessary to promote Kapton Arc Propagation.

Circuit:

Quiescent Circuit Configuration.

Procedure:

All three channels will be energized.

Voltage incremented from 145 Vdc.

Create an arc after every increment in voltage.

Results:

Propagation occurred at 192 volts.

Arc did not cross over fat return lines.

Results:

* **Kapton pyrolysis, which leads to the arc tracking and propagation even can occur on the SSF FCC.**
* **With the current power specs of the photo-voltaic array (160 V, 5 amps) a spark can ignite the Kapton pyrolysis catastrophe.**
* **With improved thermal design, the arc tracking event may be inhibited or short lived.**