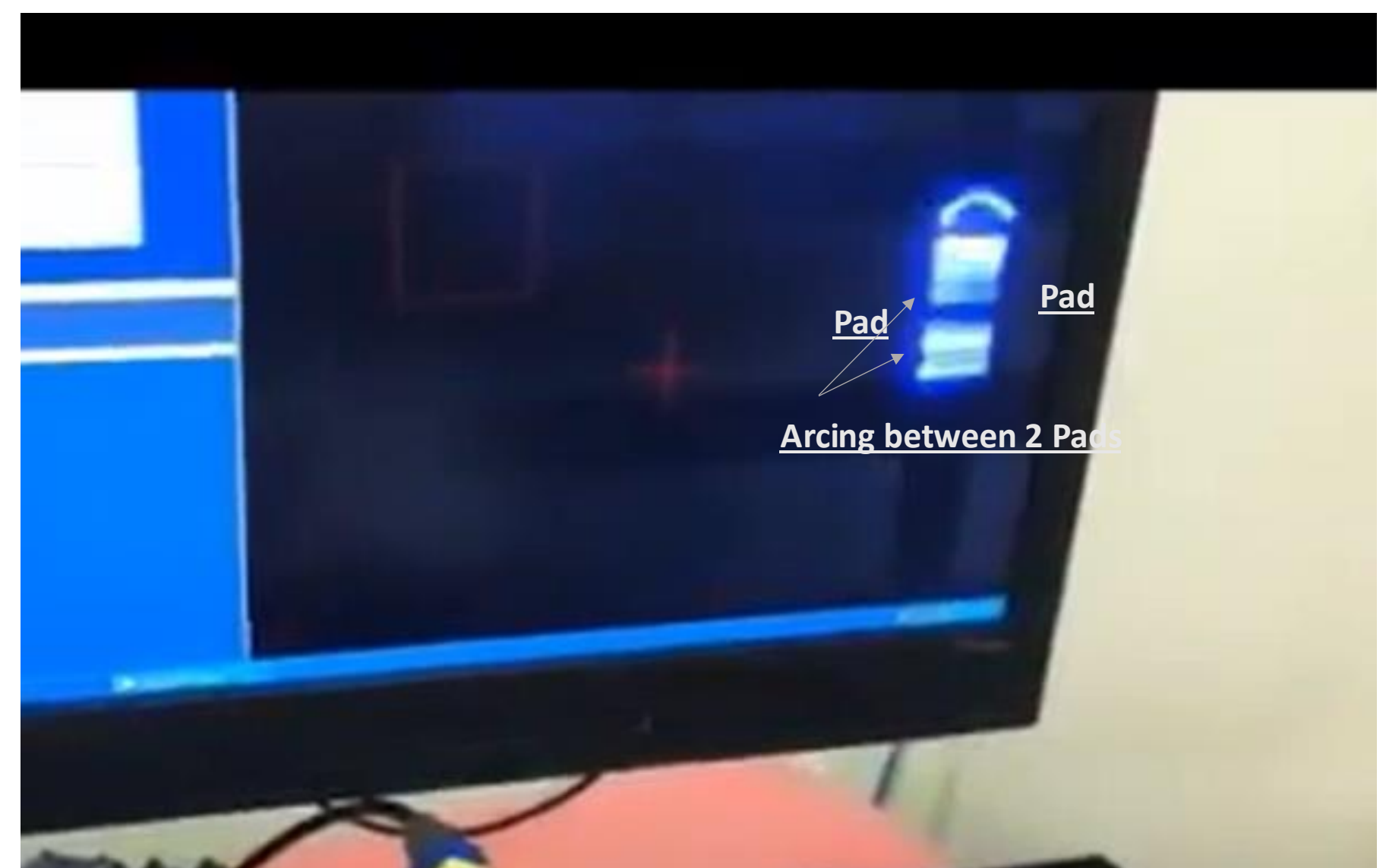
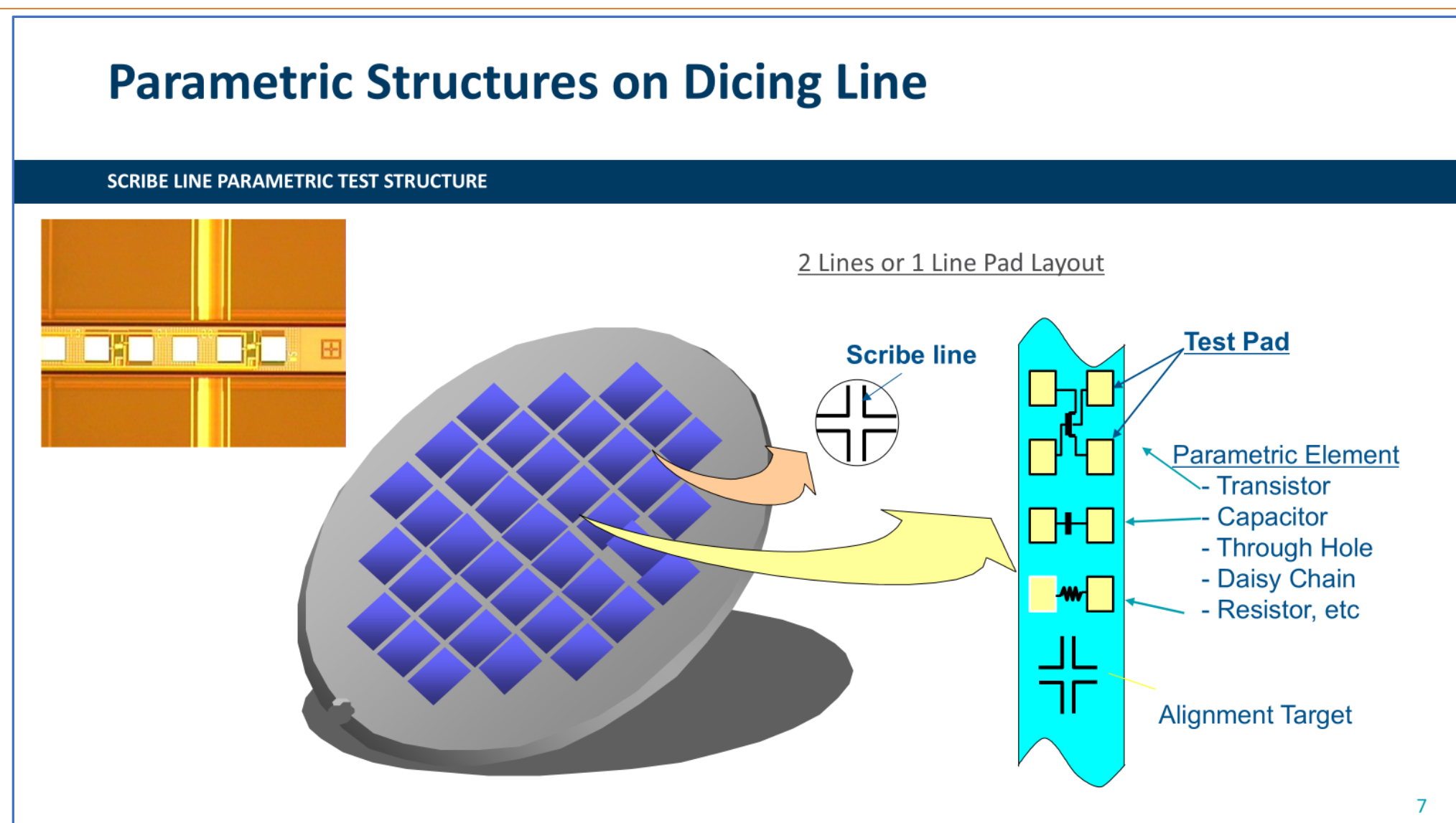


High Voltage Parametric Testing

• Introduction

- Parametric test is the simple element testing to check the wafer process condition. Parametric structures are located on the dicing line. Normally less than 20V, occasionally up to 200V has been applied for all type of devices.
- Recent power devices and automotive devices require the parametric testing with higher voltage testing up to 1,000V.
- Formfactor published the report at the SWTest 2014; Cost Effective 1,000V High Voltage Parametric Test Technique, further investigation continued to identify important parameters.
- MEMS probes use their precision to achieve stable probing of narrow and small pads.
- In other words, due to the narrow gap, high voltage testing requires careful procedures.
- This paper follows up the previous study and describes techniques to stably perform high voltage testing up to 1000V using FormFactor MEMS probes



• Testing Challenge

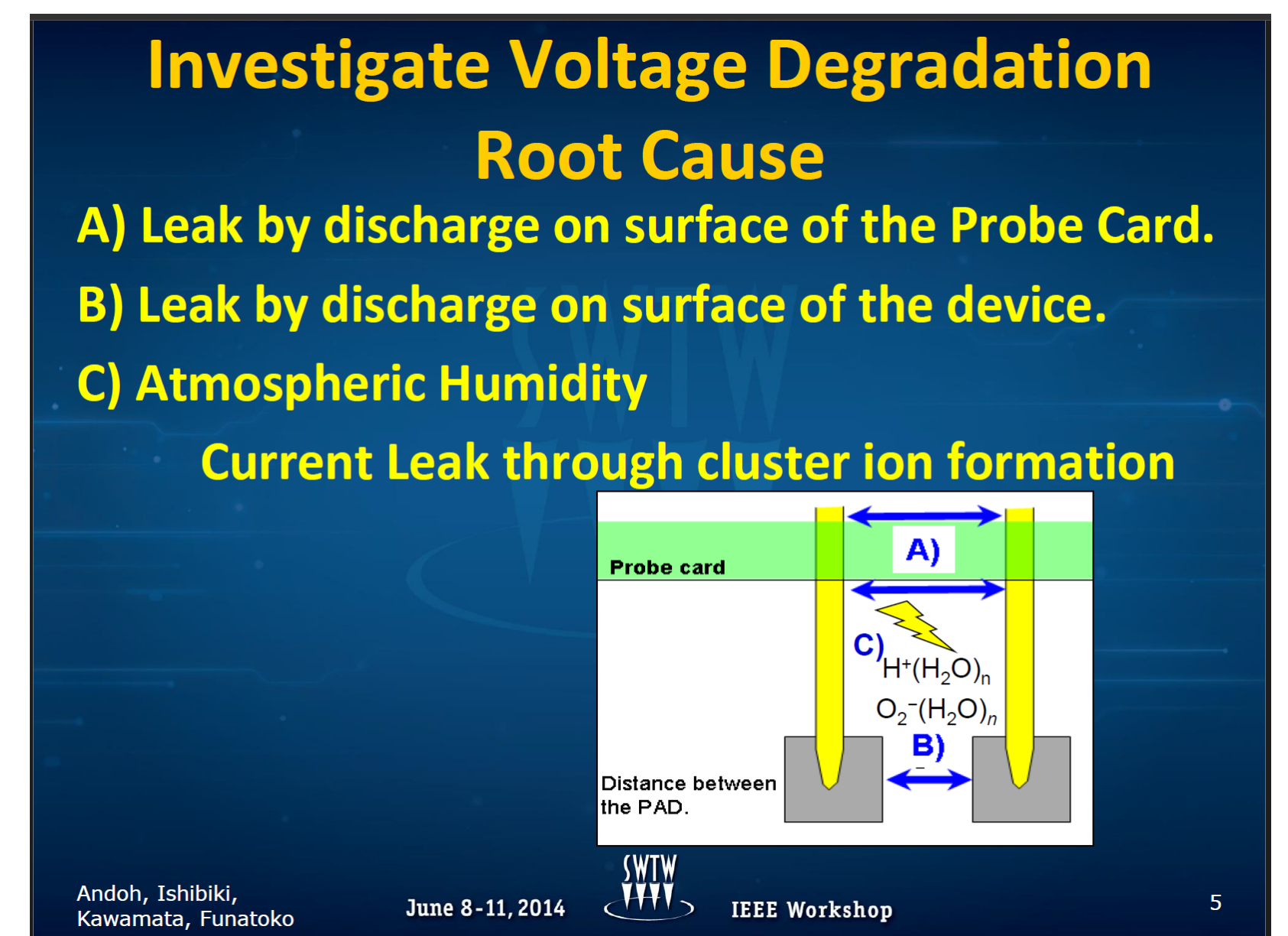
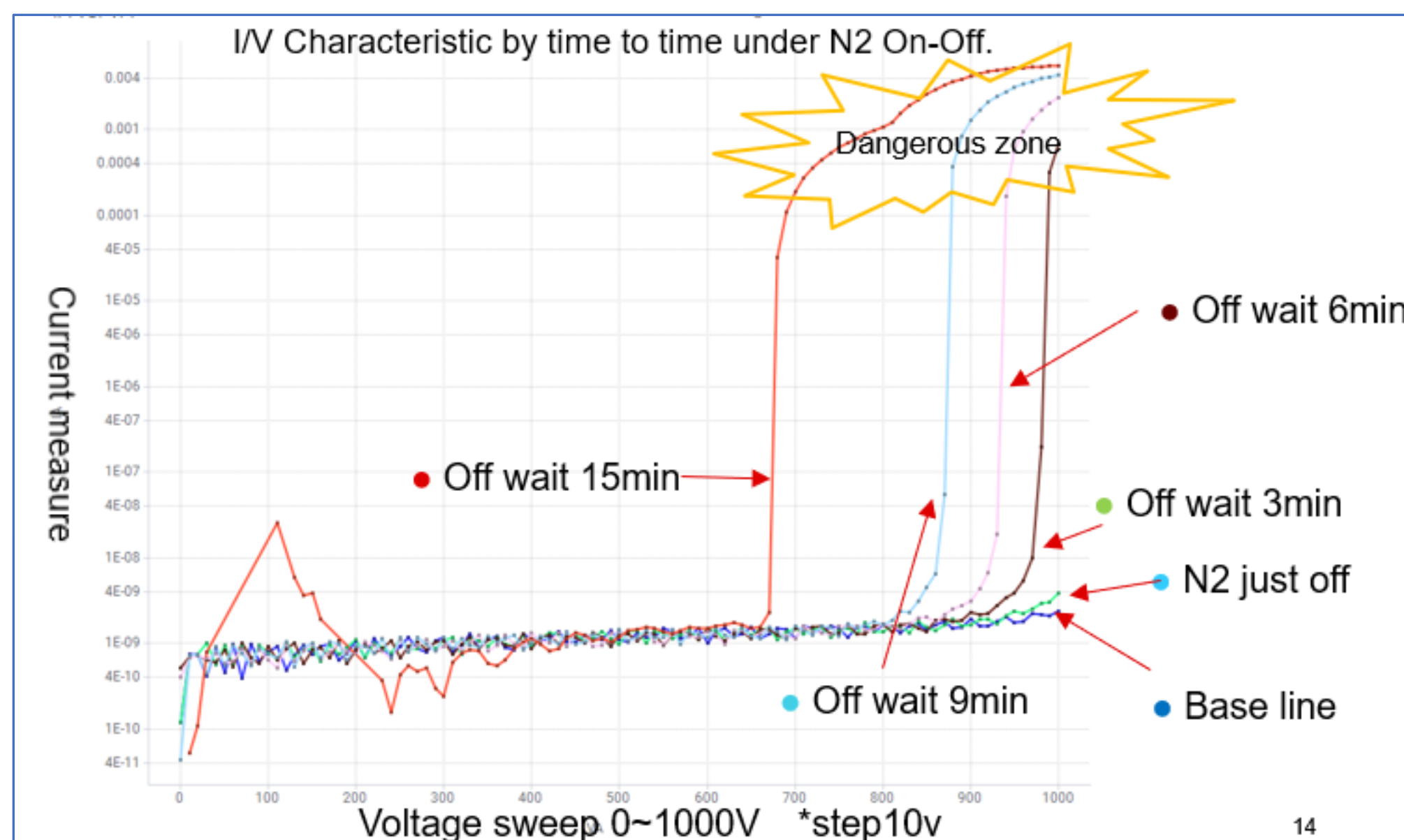
- Transistors' gate oxide and capacitor breakdown voltage measurement is typical high voltage testing.
- Breakdown voltage comes down significantly by various reasons.
- High voltage parametric testing up to 1,000V brings unexpected higher current leakage and micro arcing mainly caused by 3 sources.
- Surface on Probe Cards
- Surface on Wafer/Device
- Atmospheric Humidity
- Counteractions are tried to improve measurement stability

MORE EFFECTIVE HIGH VOLTAGE(1,000V) PARAMETRIC TEST TECHNIQUE WITH MEMS PROBE CARD

Takao Saeki, Formfactor Inc.

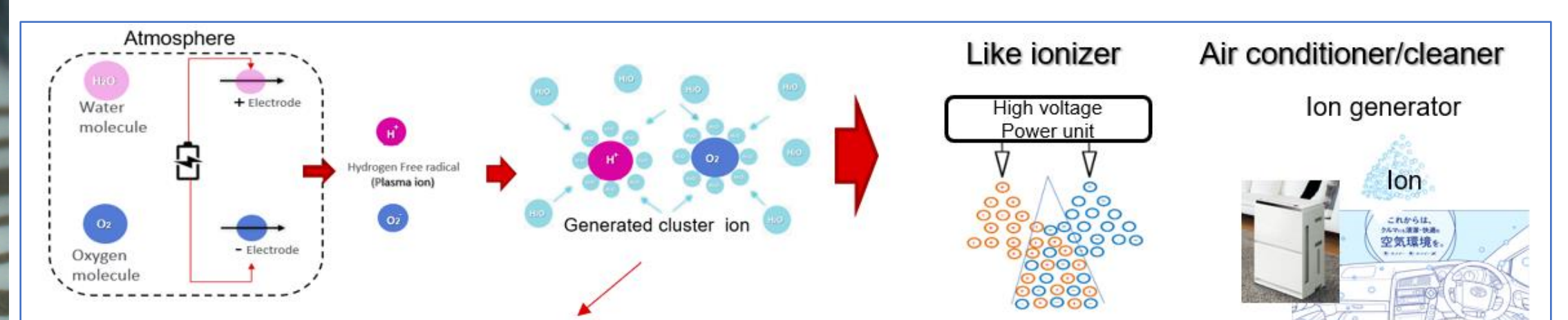
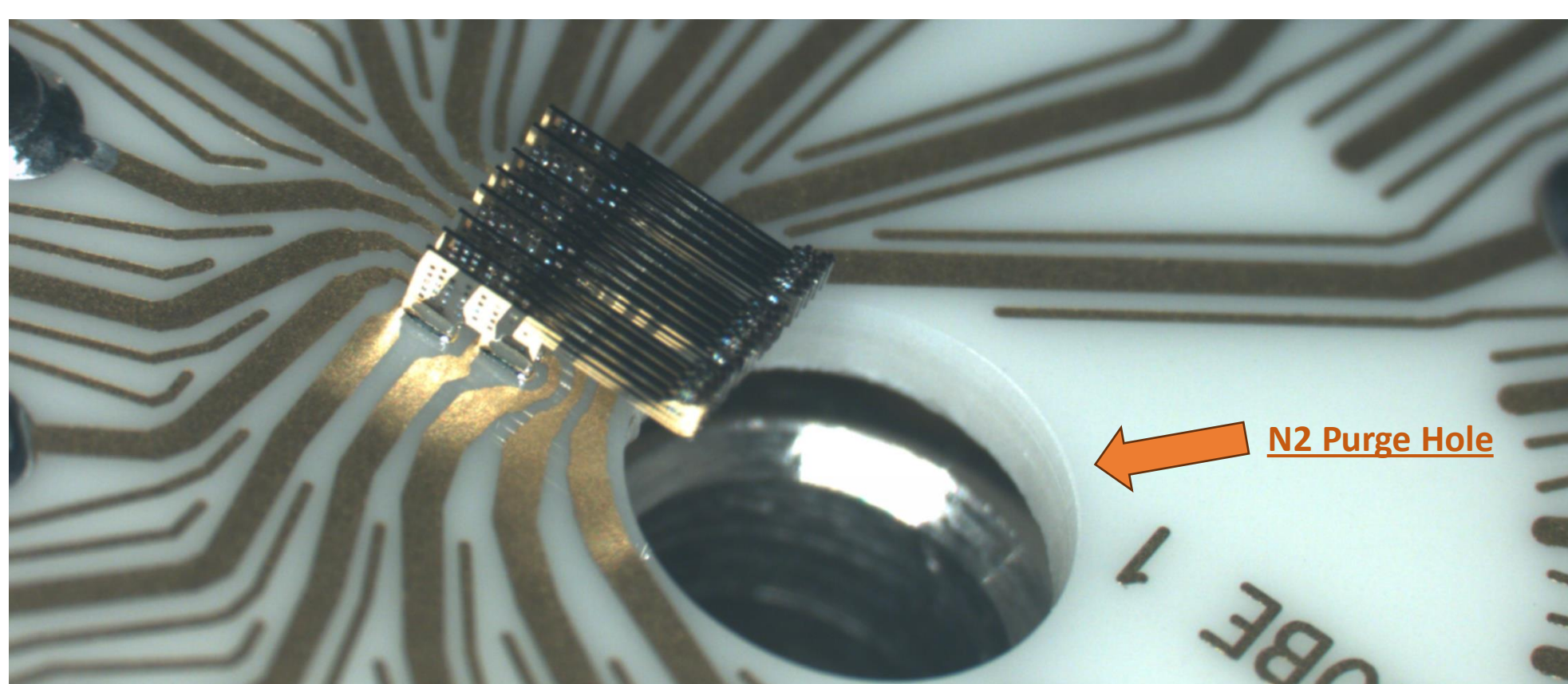
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- Breakdown voltage comes down significantly by various reasons.
- High voltage parametric testing up to 1,000V brings unexpected higher current leakage and micro arcing mainly caused by 3 sources.
 - Surface on Probe Cards
 - Surface on Wafer/Device
 - Atmospheric Humidity
- Various counteractions are considered to improve measurement stability



• Counteractions

- “A”; Probe Card Improvement
 - Formfactor T18.2, MEMS Cantilever type probe
 - Substrate; Low-k Ceramic substrate
- “B” and “C”; Atmosphere Improvement
 - Water/moisture Ions are generated from cohesive ion/water molecule
 - High voltage between electrode can generate the cluster ions like Air Purifier
 - High level of ions case, Arcing between probes occurs. Lower level case, Device surface



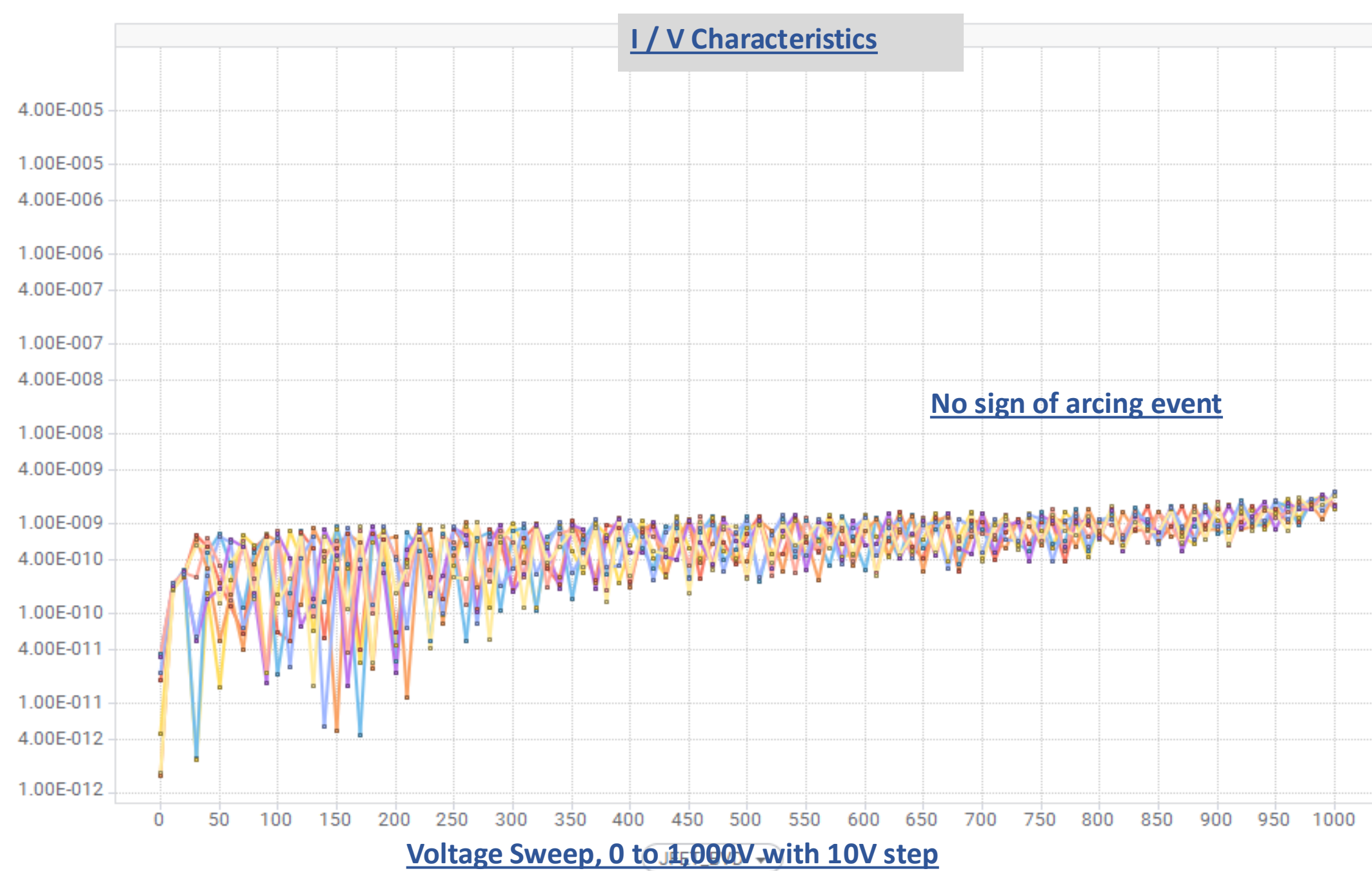


MORE EFFECTIVE HIGH VOLTAGE(1,000V) PARAMETRIC TEST TECHNIQUE WITH MEMS PROBE CARD Takao Saeki, Formfactor Inc.

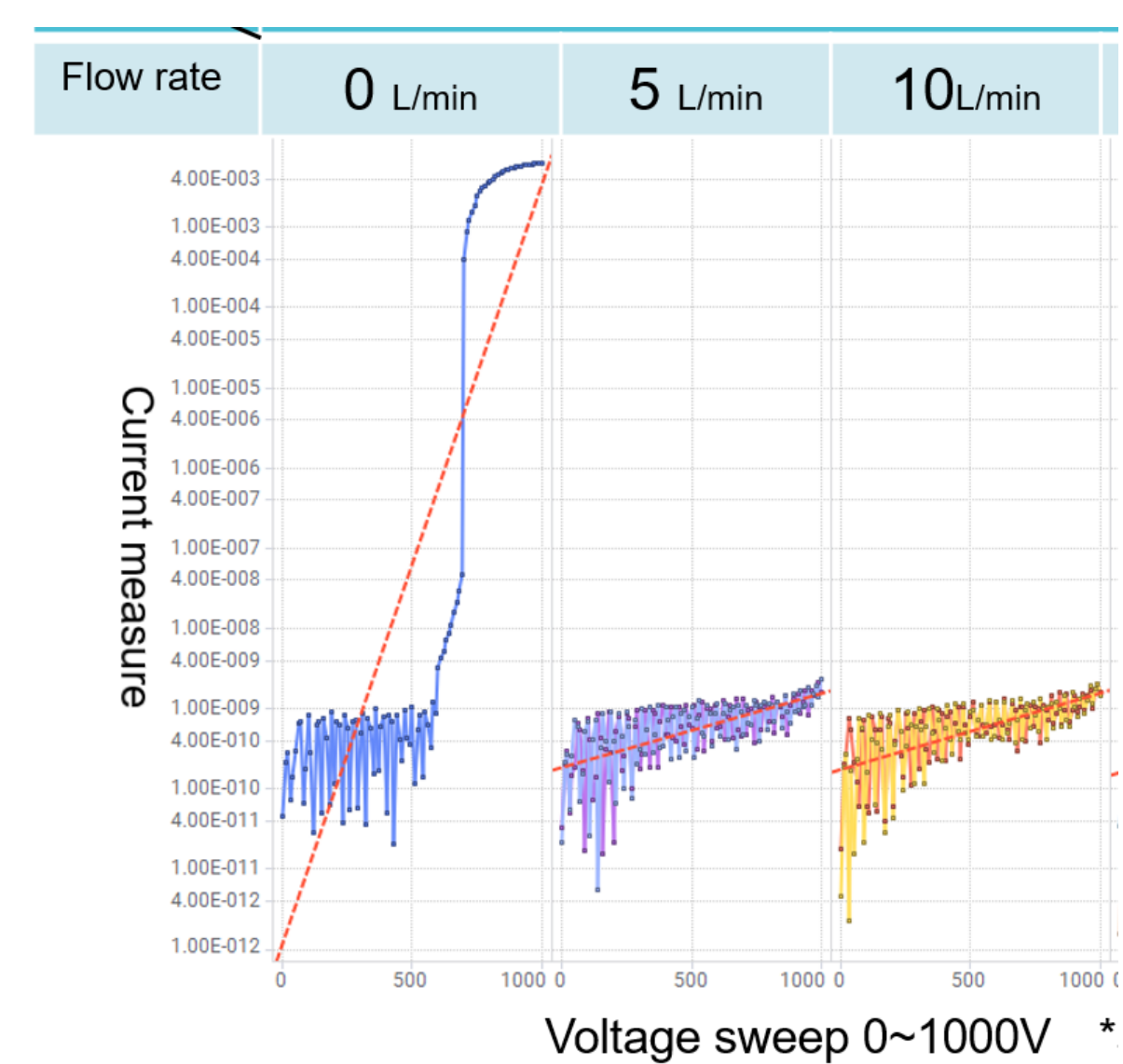


Results and Considerations

- N2 purge method has been well known method to improve the breakdown voltage measurement.
- 3 key factors identified to achieve stable and also cost effective high voltage measurement environment
 - Probe card, probe type, substrate
 - N2 purge line to
 - N2 localization are key factors
- Optimizing above conditions resulted the stable 1,000V high voltage breakdown measurement
- Lower N2 flow rate was achieved for SDGs



Confirmed effective measurement <5L/min N2 Flow Rate



Next Step

- Continue the measurement stability improvement by
- Probe card; coating all electrode surface except probe tip with non conductive material
- Chamber condition; Different gas, pressure, atmosphere maintenance method

Acknowledgement

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