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School of Electronics and Computer Science

Bridge Formation in Contaminated Transformer Oil

by

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Content

- Project aim
- Experimental setup for DC and AC
- DC test results
- AC test results
- Conclusion
- Future work

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Aim of the Research

- Understanding the Pre-breakdown Phenomena of Transformer Oil
- Laboratory Experiment Conducted on Contaminated Transformer Oil
- Modelling the Characteristics with a Computer Simulation Package

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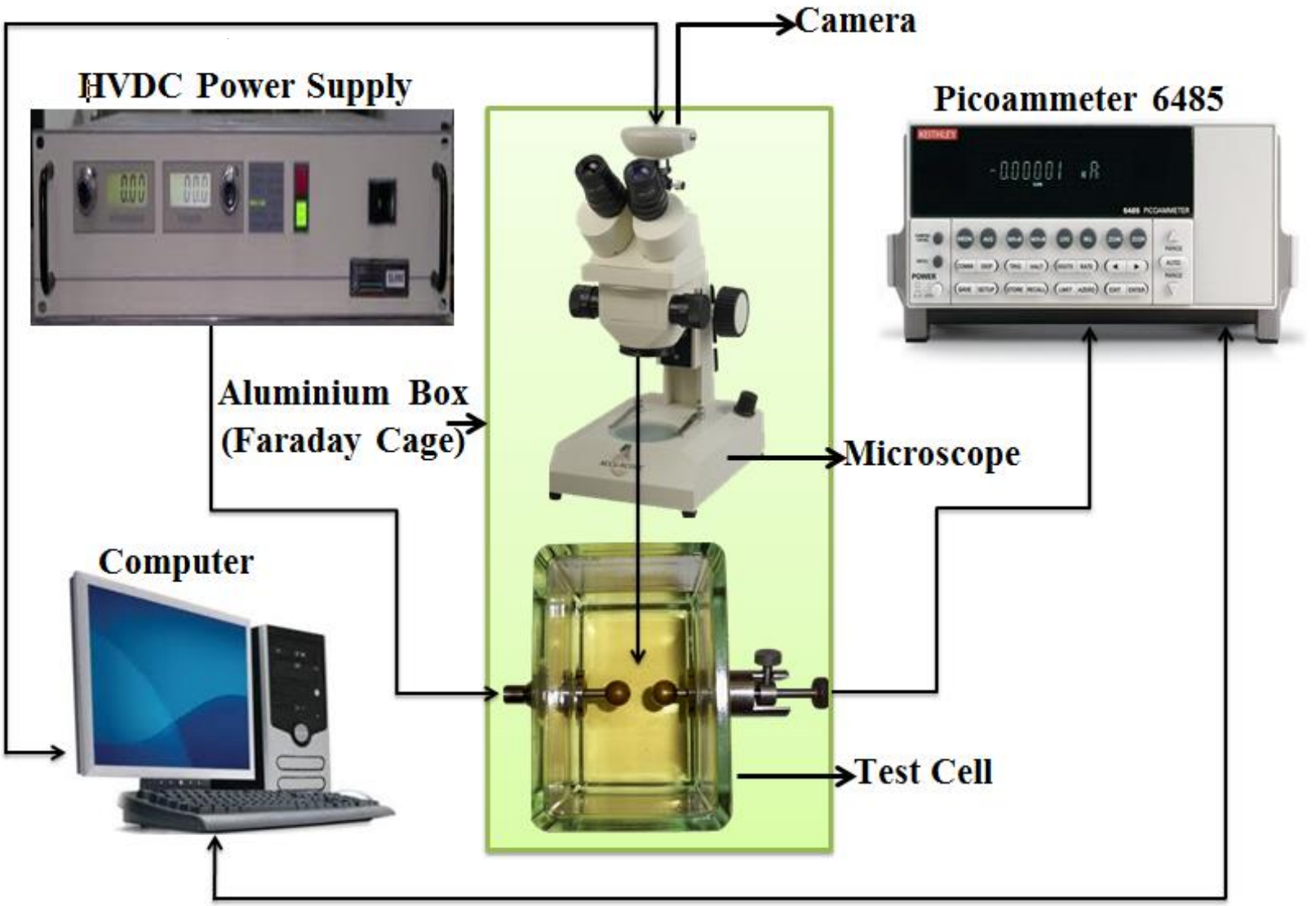
Experimental Setup for DC



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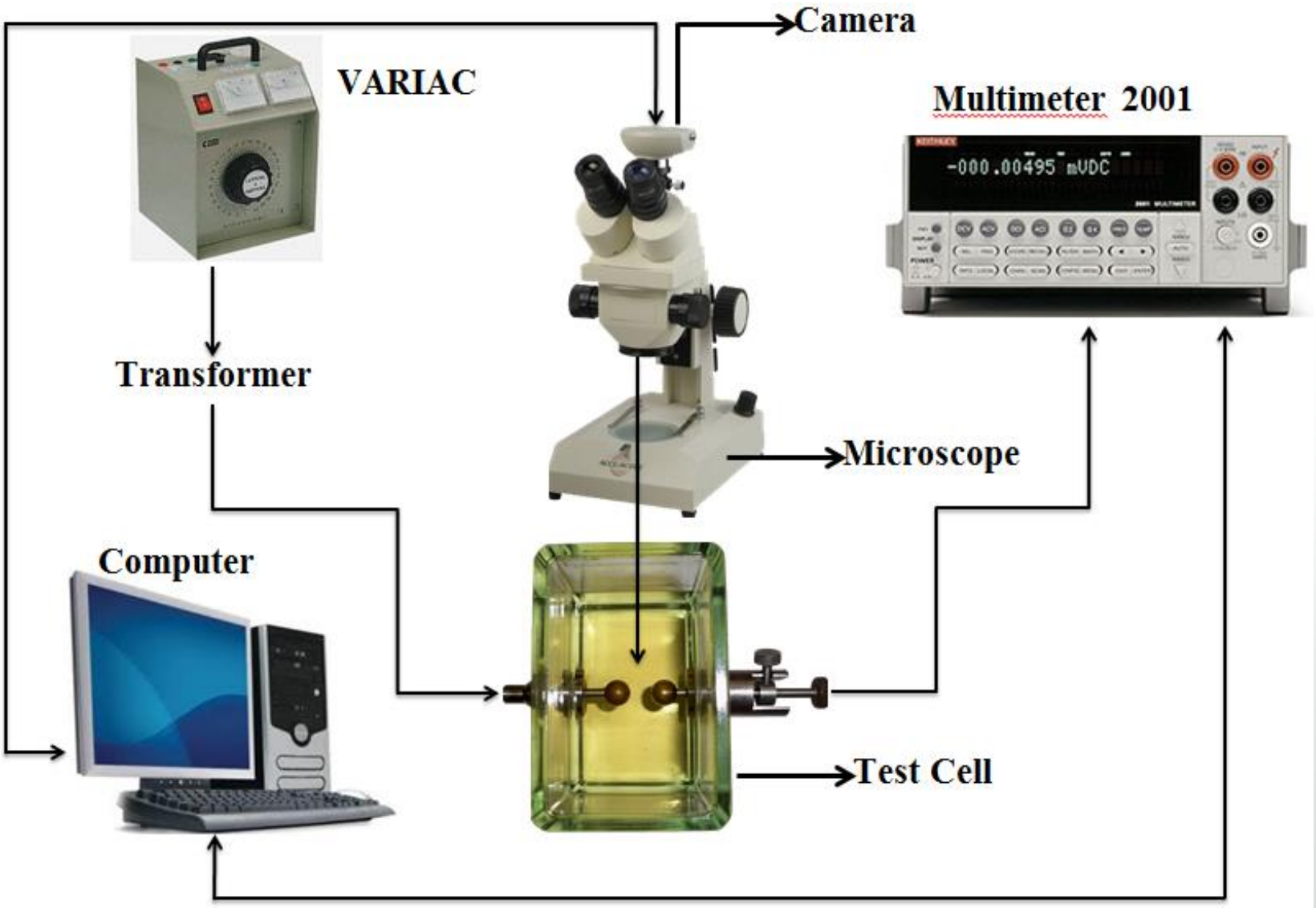
Experimental Setup for AC



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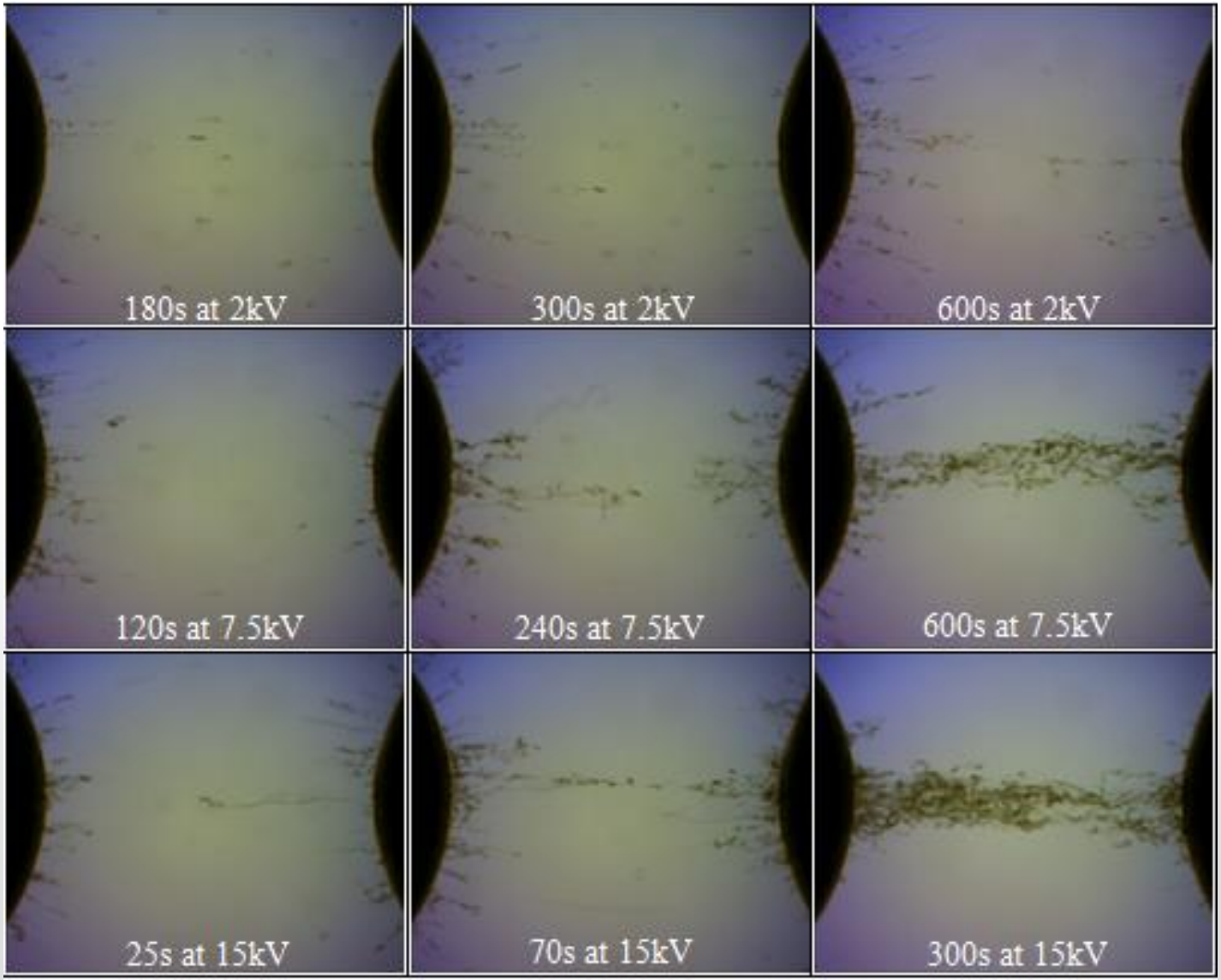
DC Bridging in 0.001% Contamination with 150-250 µm Particles



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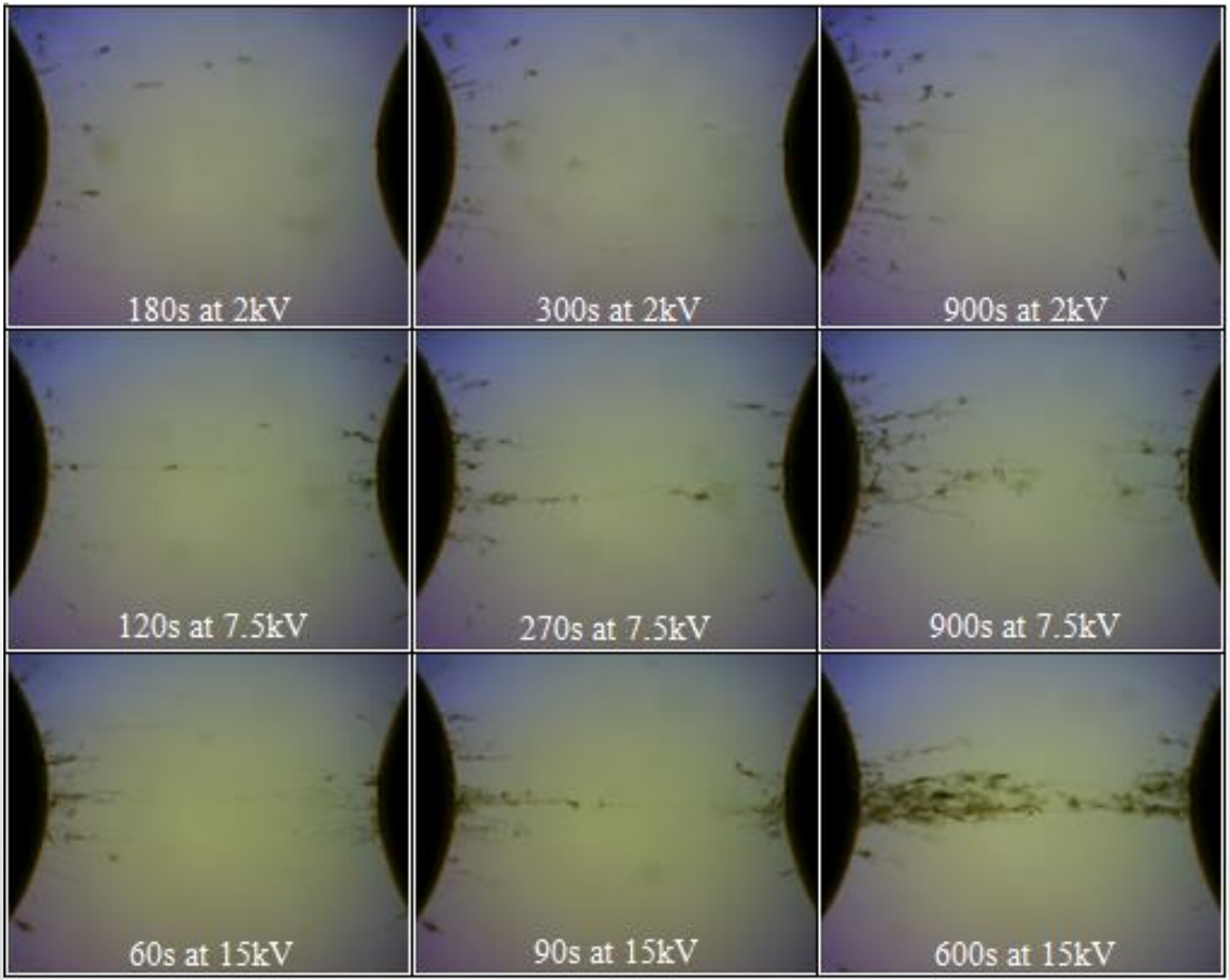
DC Bridging in 0.001% Contamination with 250-500 µm Particles



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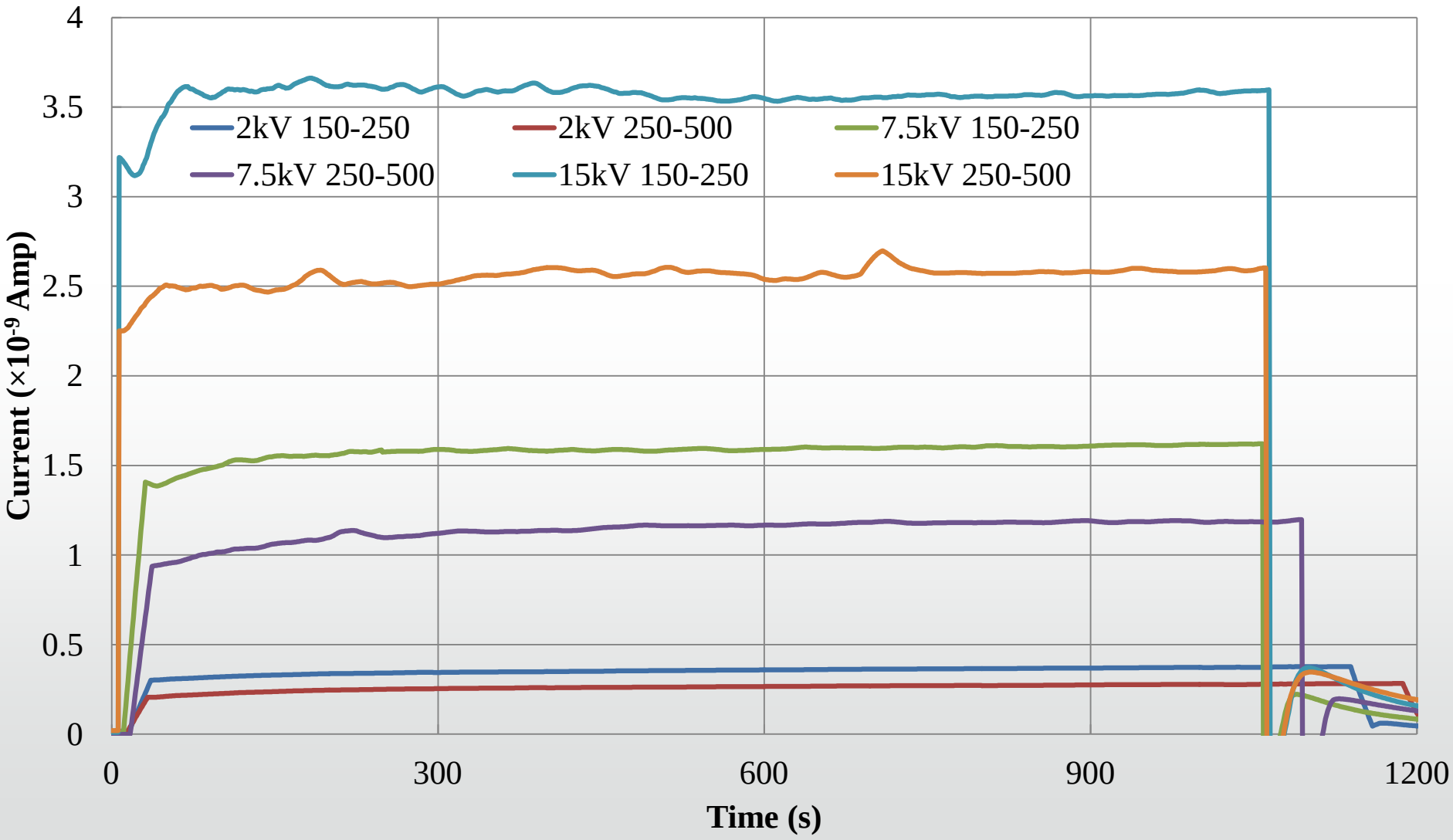
DC Current Comparison at 0.001% contamination



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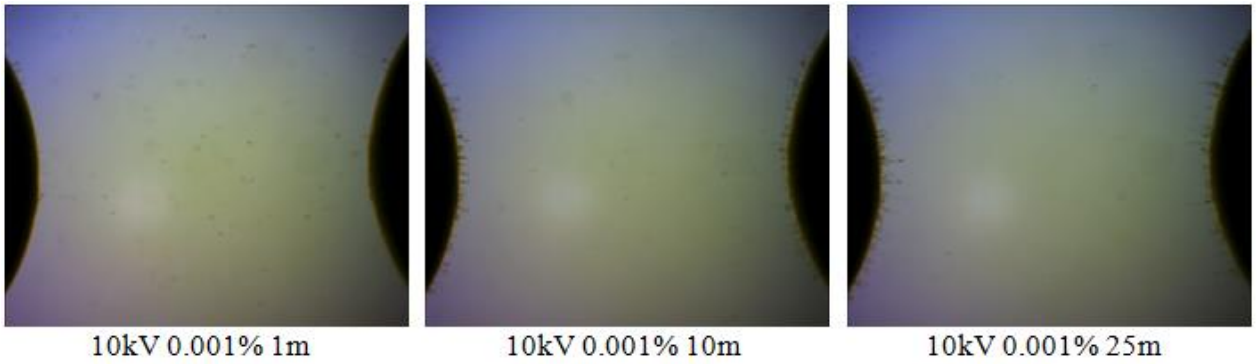
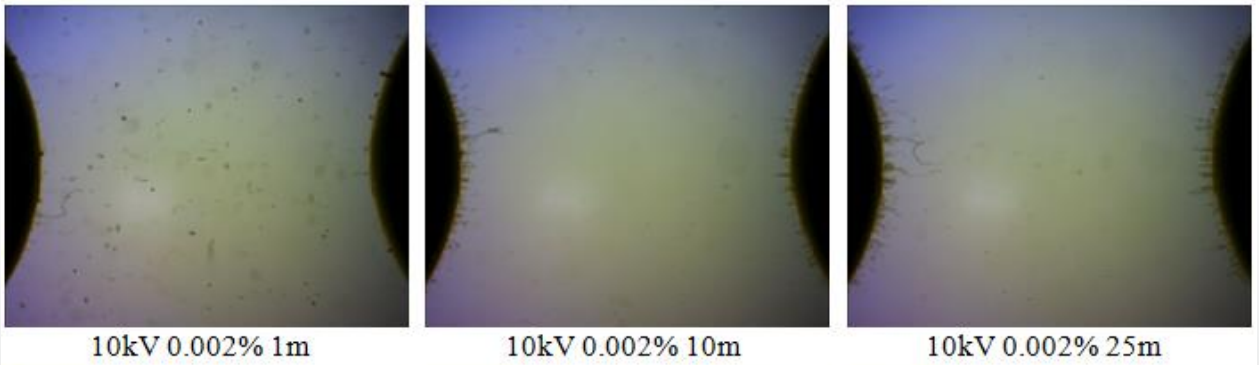
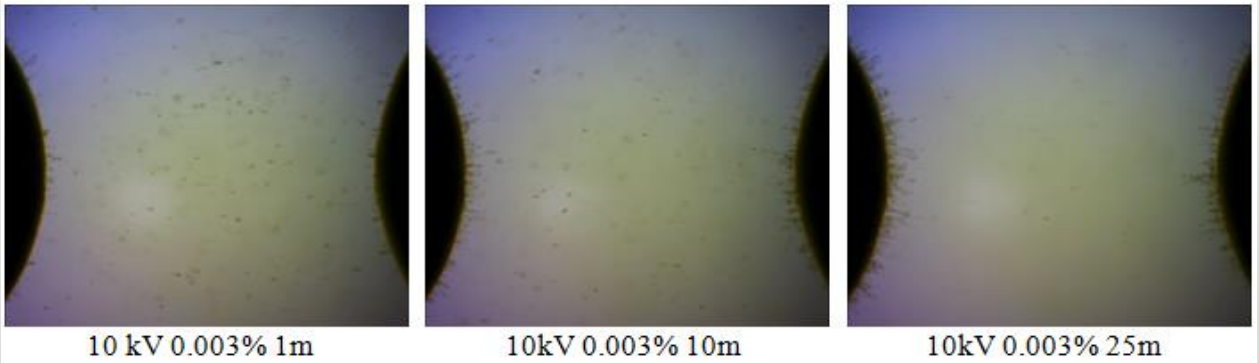
AC Bridging in different contaminations at 10kV



10kV 0.001% 1m | 10kV 0.001% 10m | 10kV 0.001% 25m



10kV 0.002% 1m | 10kV 0.002% 10m | 10kV 0.002% 25m



10 kV 0.003% 1m | 10kV 0.003% 10m | 10kV 0.003% 25m

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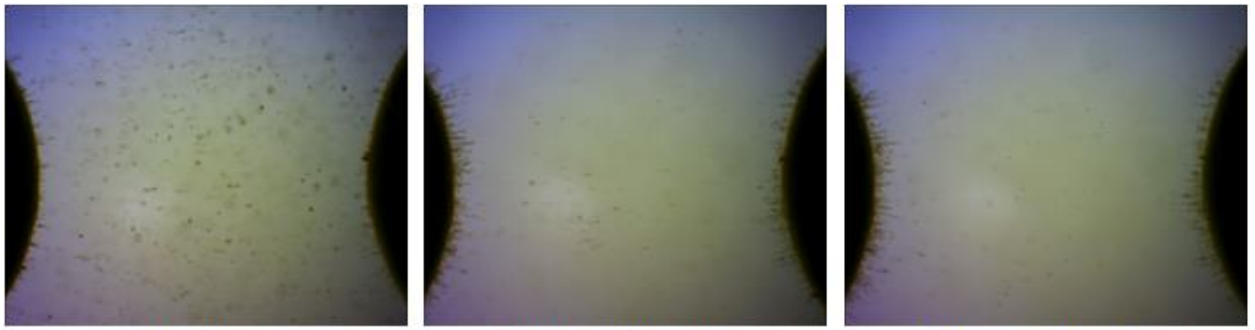
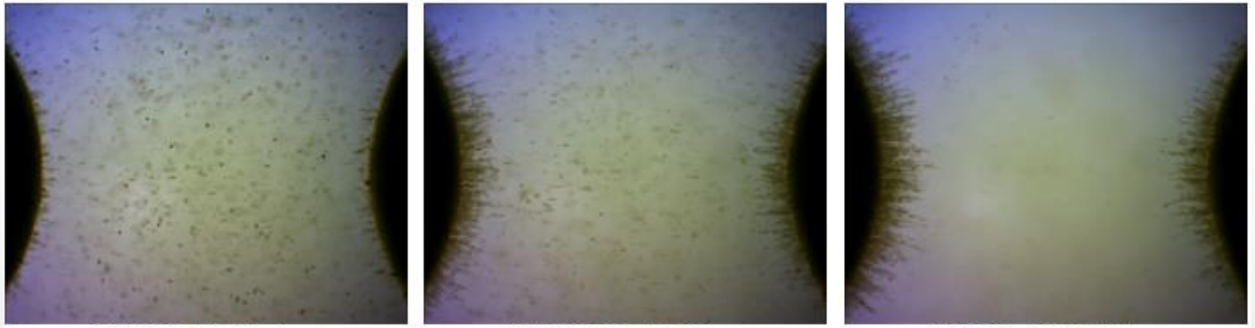
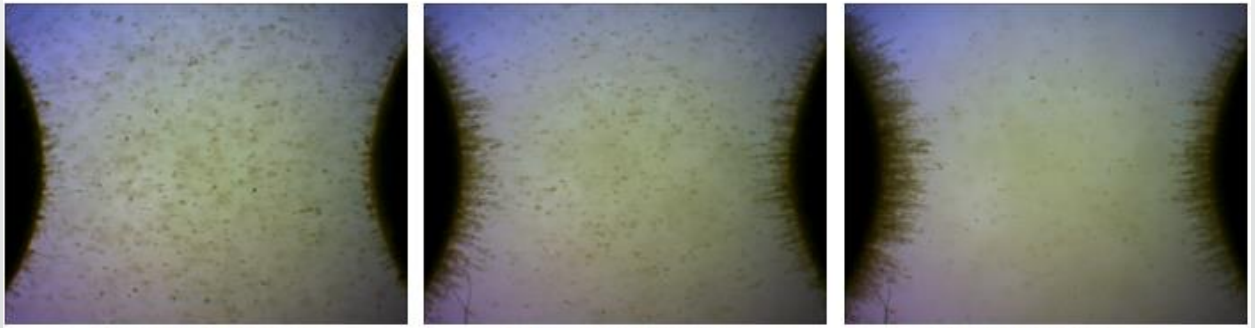


10kV 0.008% 1m | 10kV 0.008% 10m | 10kV 0.008% 25m



10kV 0.016% 1m | 10kV 0.016% 10m | 10kV 0.016% 25m



10kV 0.024% 5m | 10kV 0.024% 10m | 10kV 0.024% 25m

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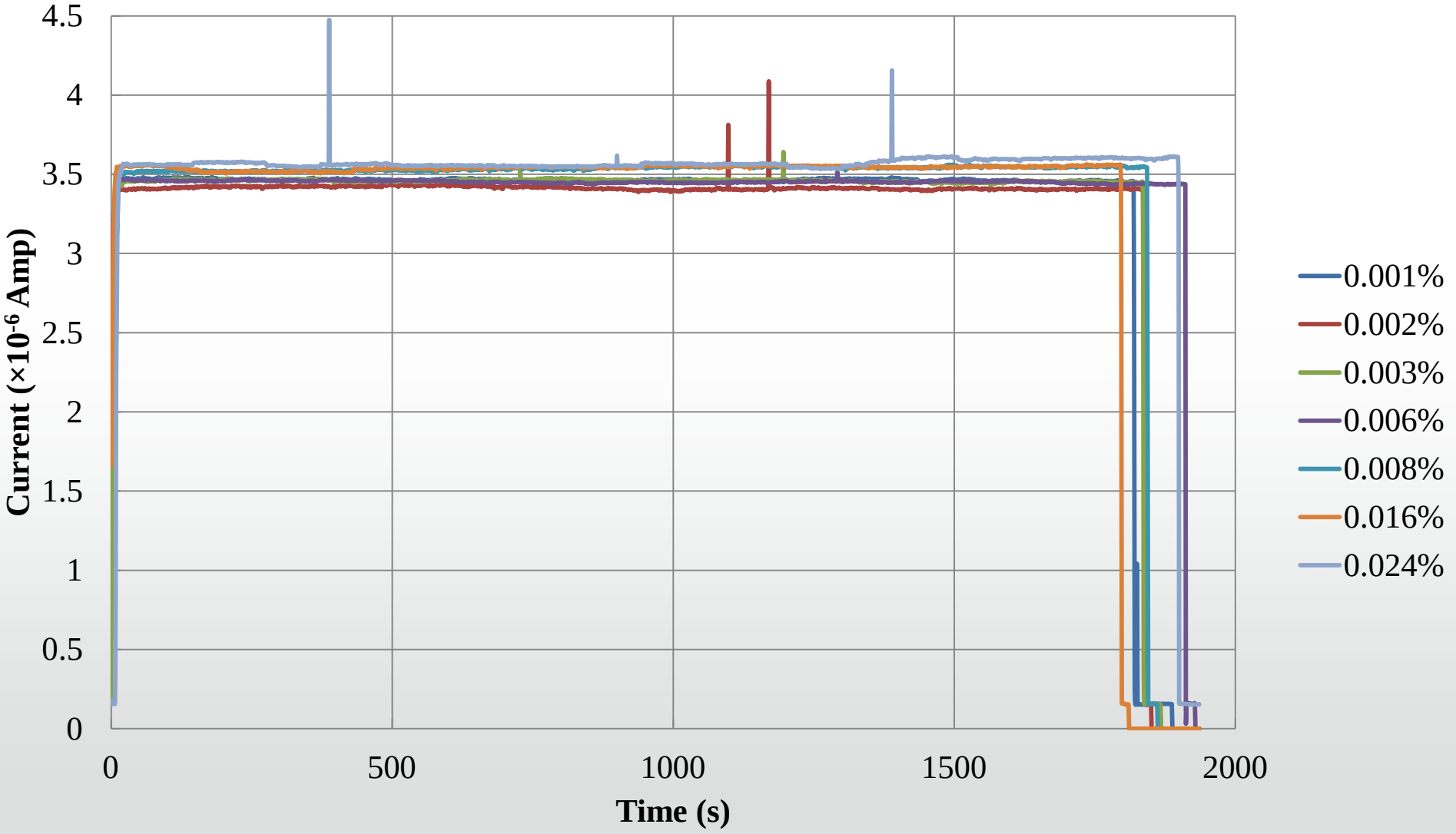
Current at different contaminations for at 10kV



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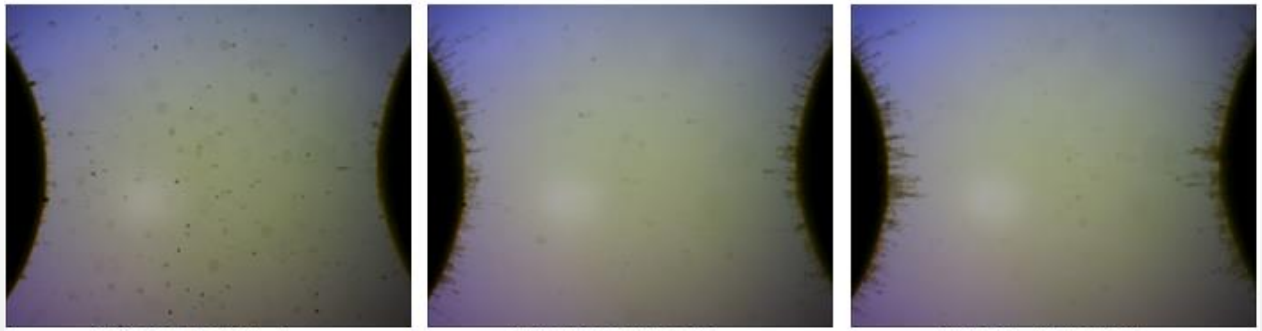
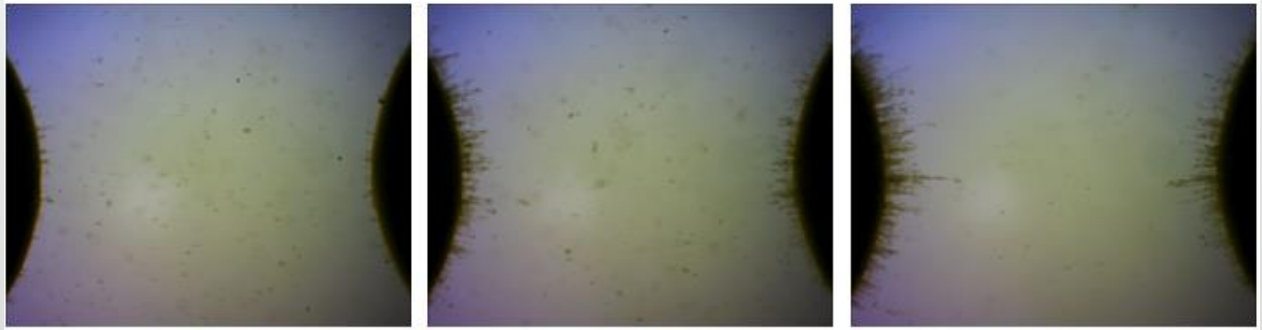
AC Bridging in different contaminations at 15kV

15kV 0.001% 1m | 15kV 0.001% 10m | 15kV 0.001% 25m



15kV 0.002% 1m | 15kV 0.002% 10m | 15kV 0.002% 25m



15 kV 0.003% 1m | 15kV 0.003% 10m | 15kV 0.003% 25m

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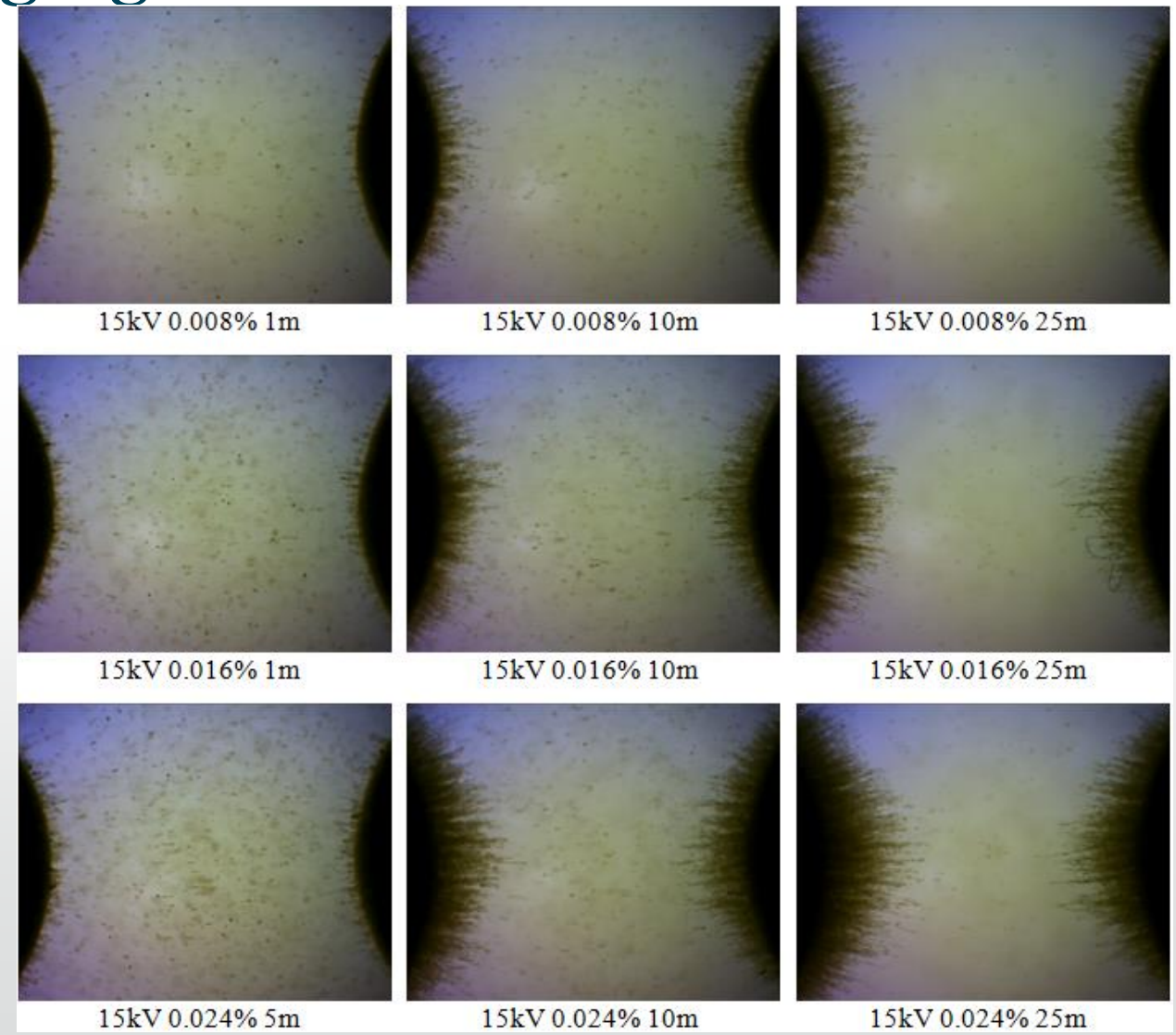
AC Bridging in different contaminations at 15kV



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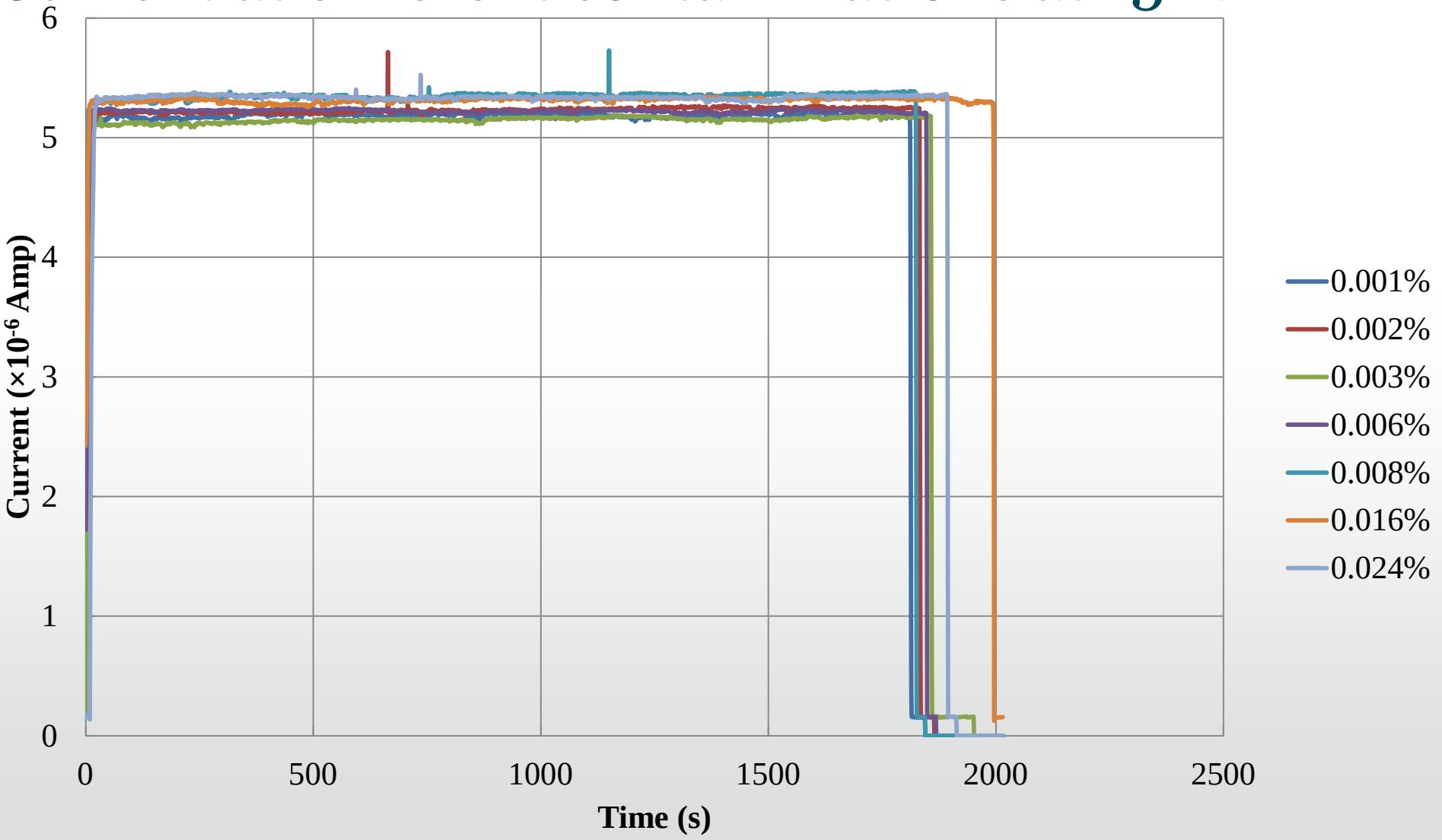
Current at different contaminations at 15kV



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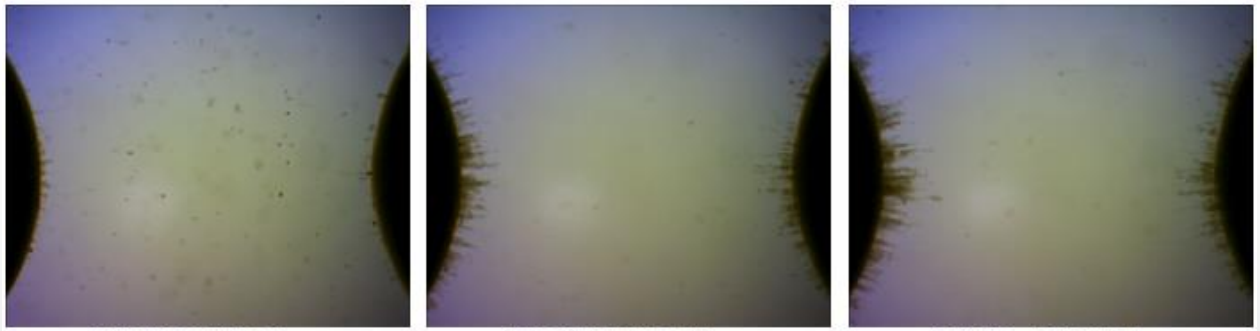
AC Bridging in different contaminations at 20kV

20kV 0.001% 1m | 20kV 0.001% 10m | 20kV 0.001% 25m



20kV 0.002% 1m | 20kV 0.002% 10m | 20kV 0.002% 25m

20kV 0.003% 1m | 20kV 0.003% 10m | 20kV 0.003% 25m

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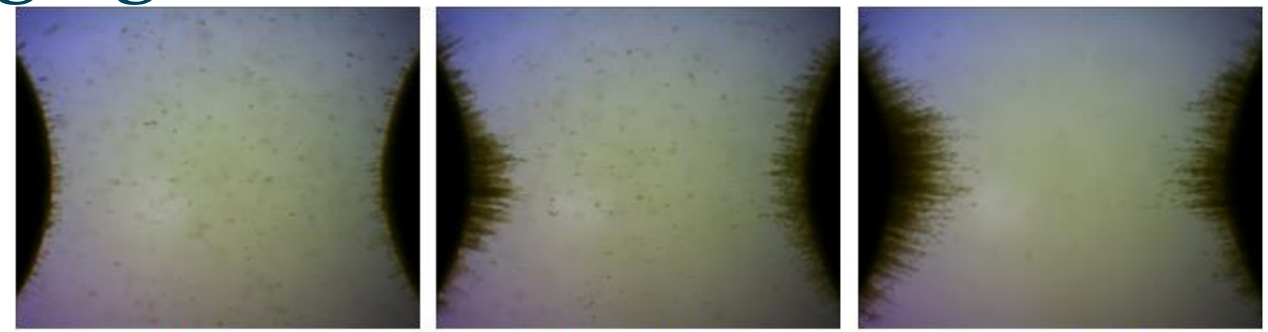
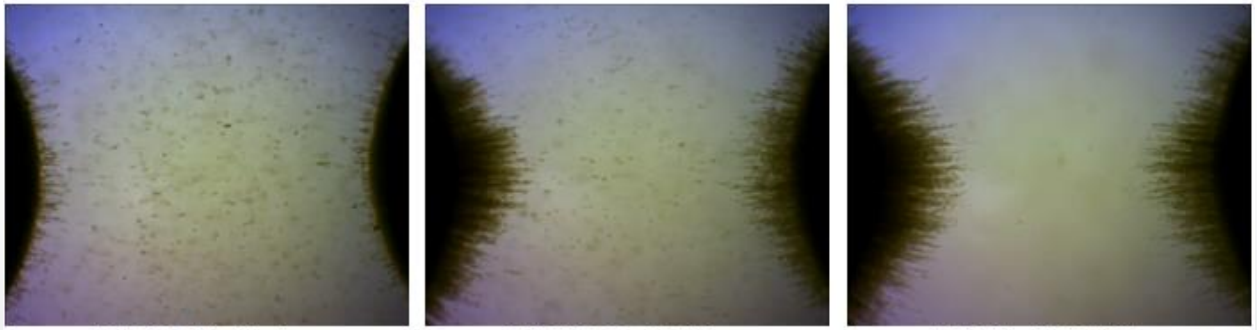
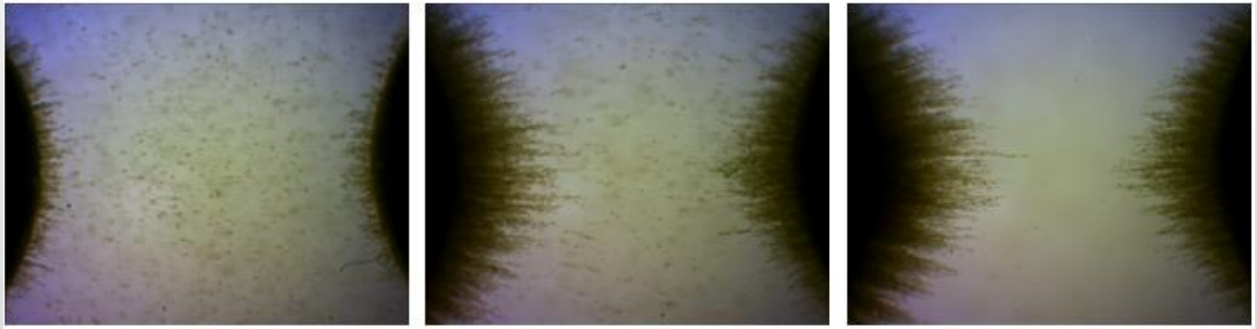
AC Bridging in different contaminations at 20kV



20kV 0.008% 1m | 20kV 0.008% 10m | 20kV 0.008% 25m



20kV 0.016% 1m | 20kV 0.016% 10m | 20kV 0.016% 25m



20kV 0.024% 1m | 20kV 0.024% 10m | 20kV 0.024% 25m

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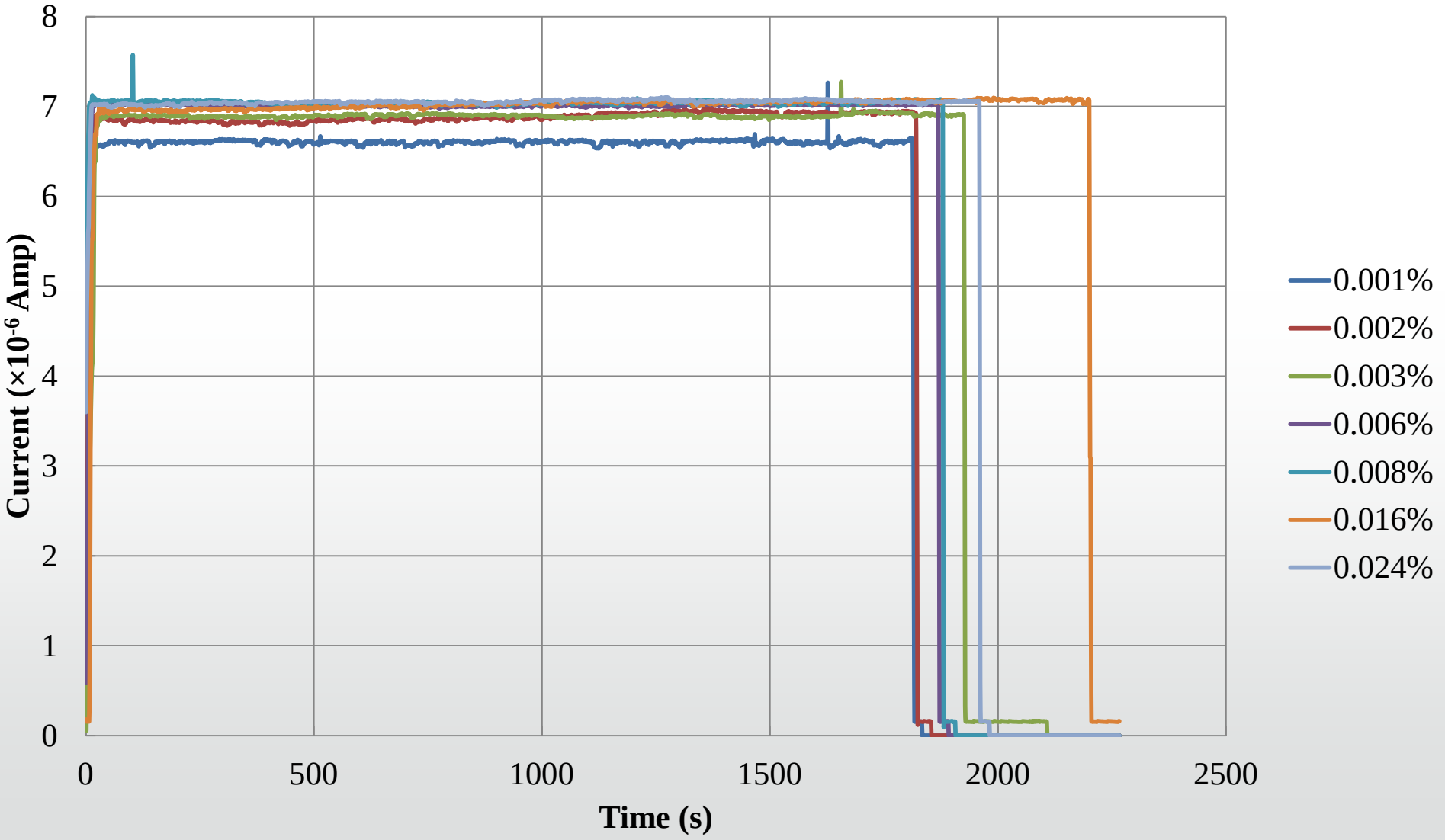
Current at different contaminations at 20kV



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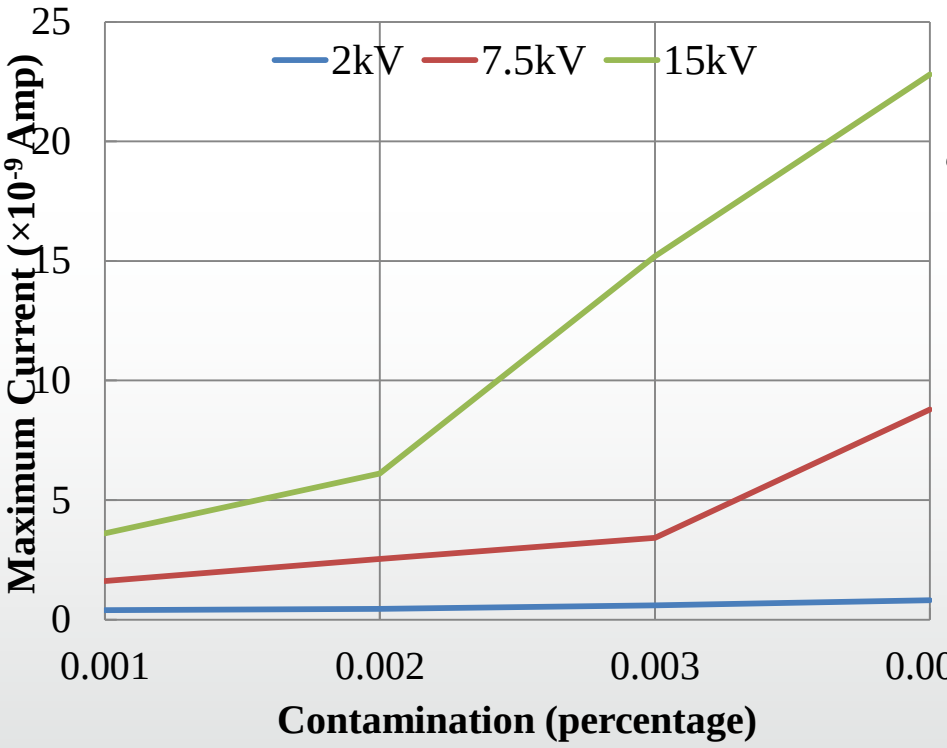
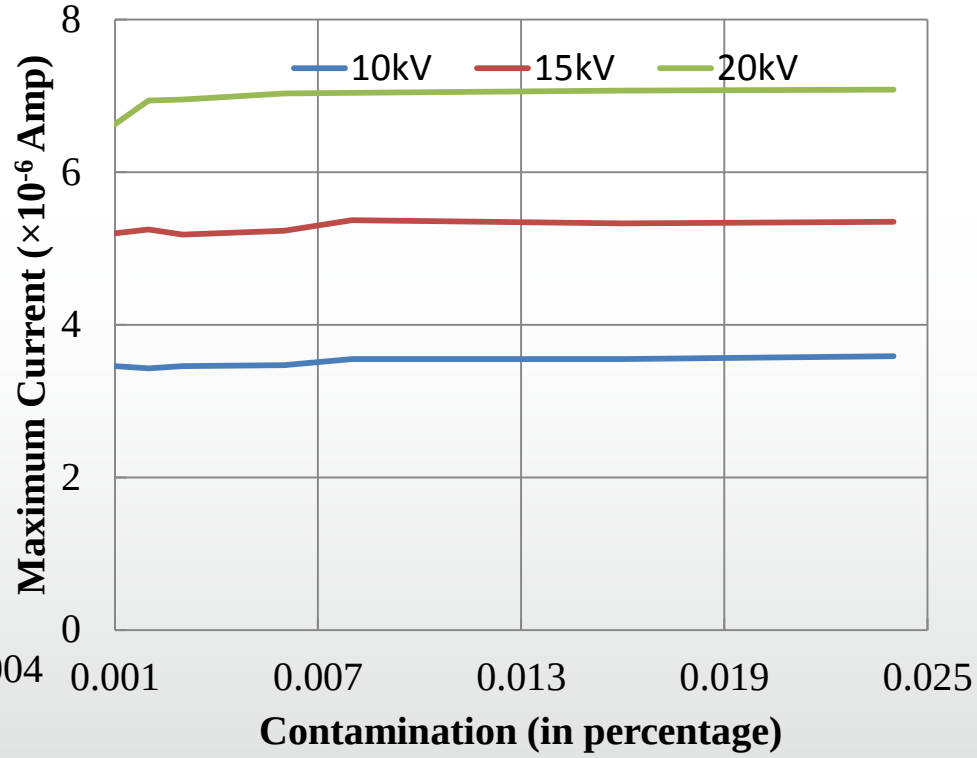
Conduction current comparison between DC and AC

For DC



For AC



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Conclusion

- A complete bridge doesn't form for AC electric field
- AC currents for different concentrations are almost constant for a certain applied voltage
- Clear evidences of two different mechanisms between DC and AC bridging
- Conductivity through the particles is the main cause of bridge formation

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Future Work

- DC and AC experiments with covered electrodes
- Experiments under DC biased AC electric field
- Numerical Modelling of AC Dielectrophoresis

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Any comments? Questions?