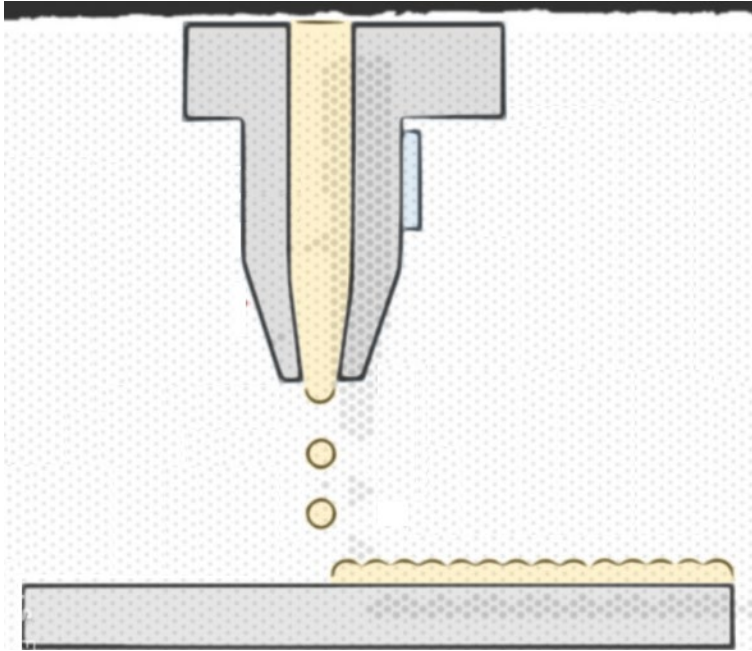




# Investigation of ink-jet printed lacquer systems for coating applications

# Challenge



Ink-jet printed, defect-free coating ?

How to **do** it?

How to **test** it?

# iPrint

- **Applied** Research institute @HEIA / HES-SO



# Ink-jet@iPrint



**iPrint**   
**inspire.  
challenge.  
create.**





# Goal

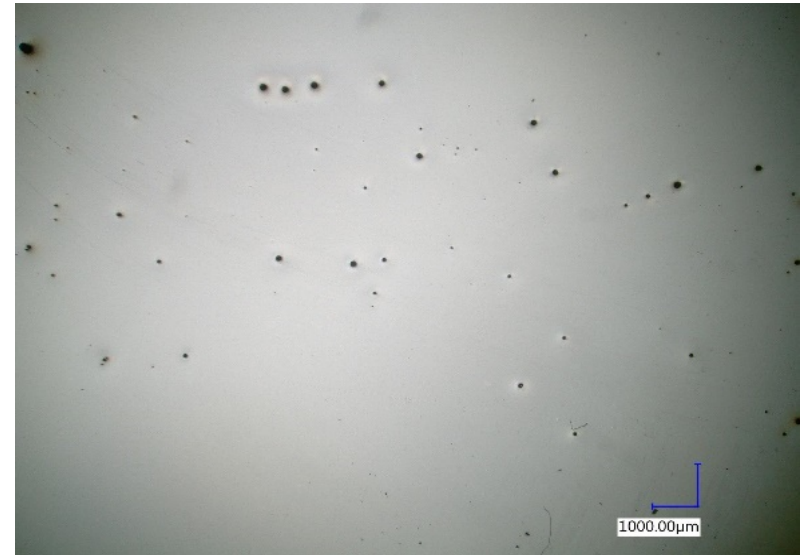
- Electrical engineering
  - Coating over energized nodes



- Different thicknesses (Thickness on Demand)

# Challenge

- Electrical engineering
  - Coating over energized nodes
  - Thickness on Demand
  - **Defect-free** ?
    - How to **test** it ?

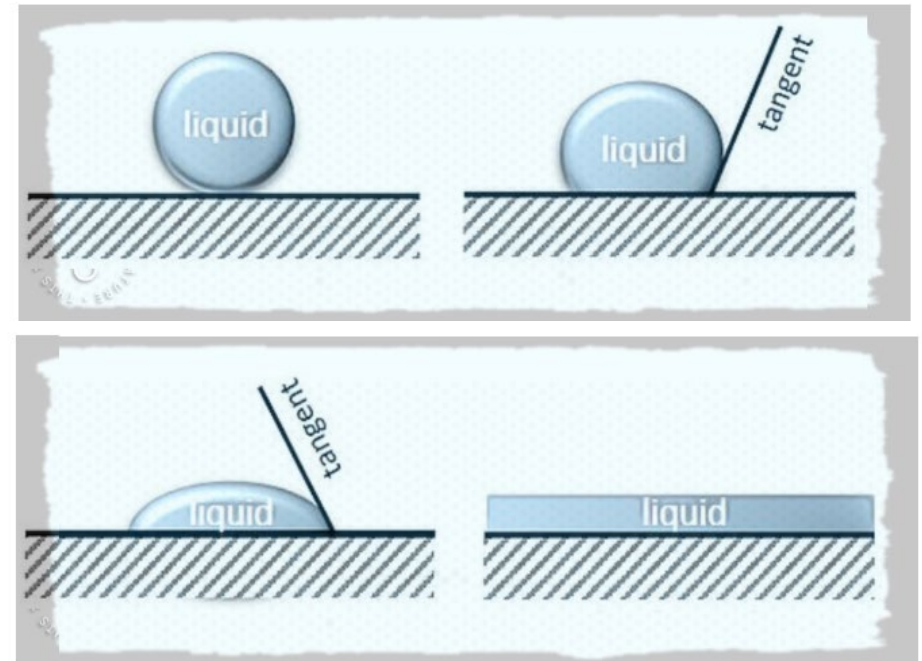
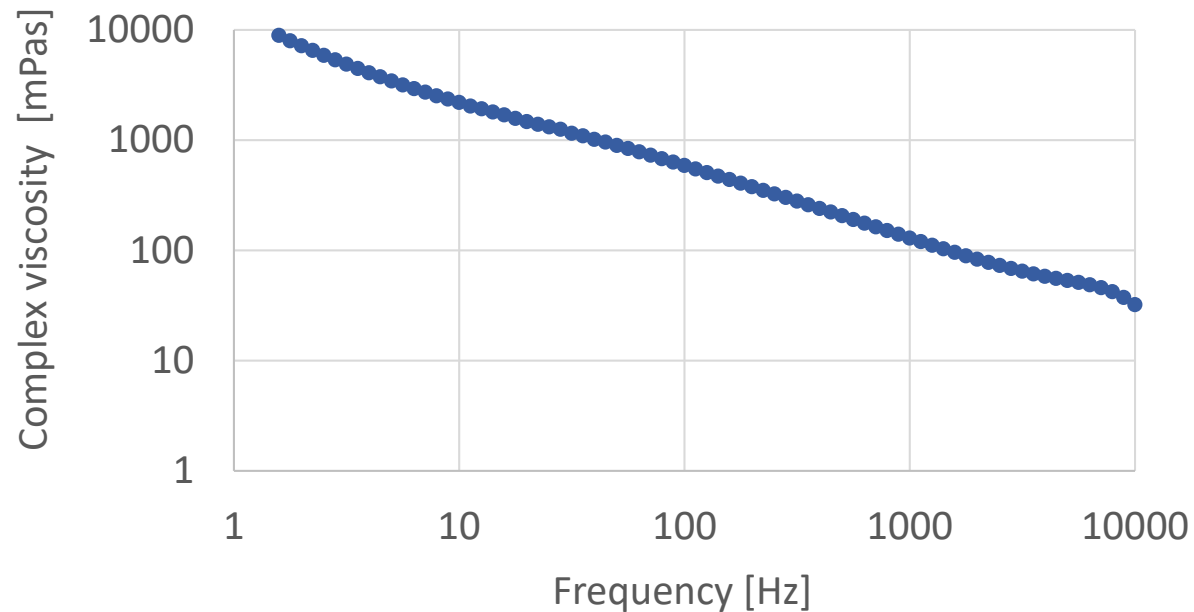


# Action plan

- ① Prepare single layers by spin coating
- ② Repeat for multi-layered coatings
- ③ Replace spin-coating by ink-jet
- ④ Validate the multi-layered ink-jet printed coatings

# Initial coating investigation

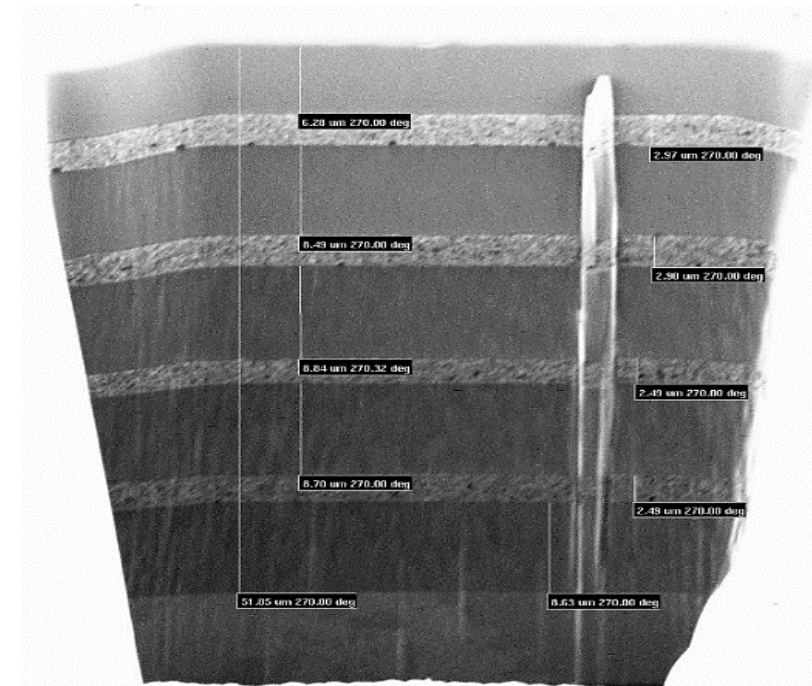
- Rheology and surface energy





# Spin-coated multilayers

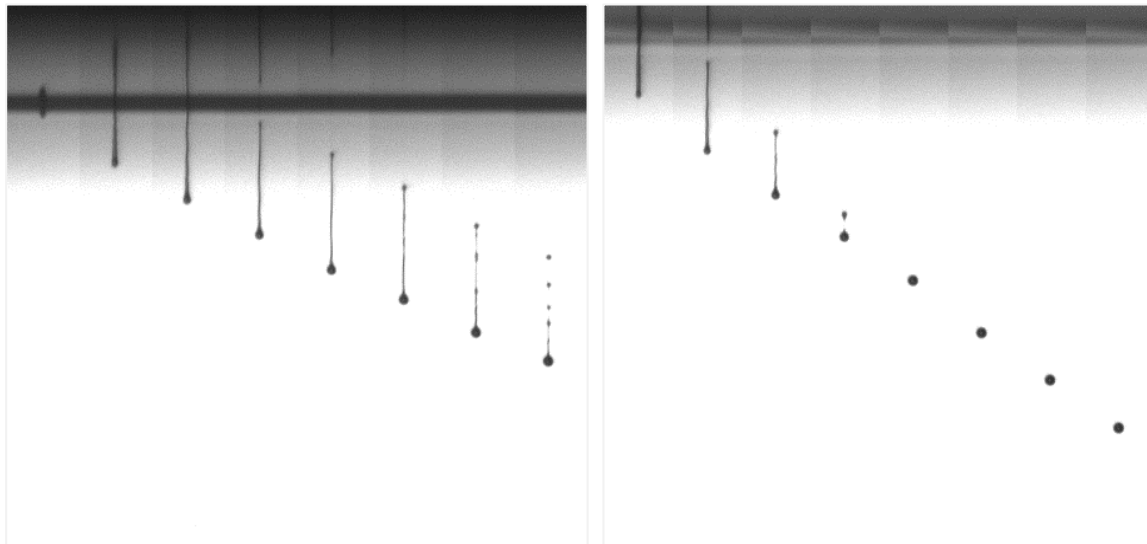
- Initial de-wetting on multilayers → successful spin-coated multilayers



FIB microscopy – after spin coating

# Ink-jet coating investigation

## ■ Drop watching



Manufacturer		Nozzles	Native resolution [dpi]	Nozzle pitch [um]	Channel count
Fujifilm Dimatix	Type ...	1024	400	63.5	2
Fujifilm Dimatix		512	200	127	2
Fujifilm Dimatix		2048	1200	21.2	1
Konica Minolta		1776	600	42.3	1
Konica Minolta		1024	360	70.6	1
Ricoh		1280	600	42.3	2
Ricoh		1280	600	42.3	2
Ricoh		1280	600	42.3	2
Ricoh		1280	600	42.3	2
Ricoh		1280	600	42.3	4
Seiko		1536	360	70.6	1
Seiko		1536	360	70.6	1
Xaar		1000	360	70.6	1
Xaar		1000	360	70.6	1

# Ink-jet coating investigation

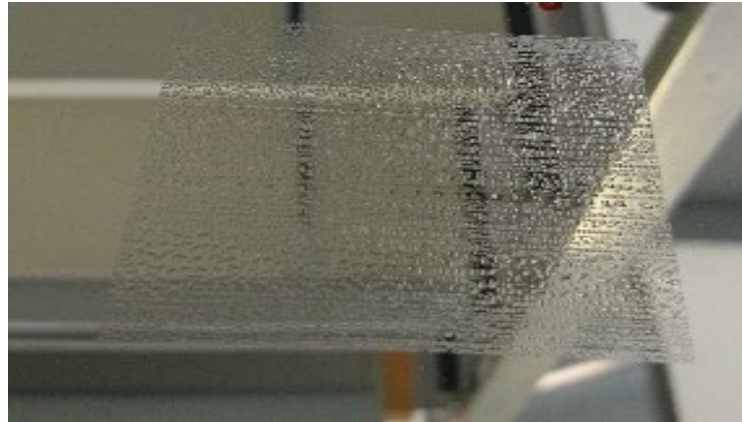
- Ink-jet optimization





# Typical ink-jet coating tests

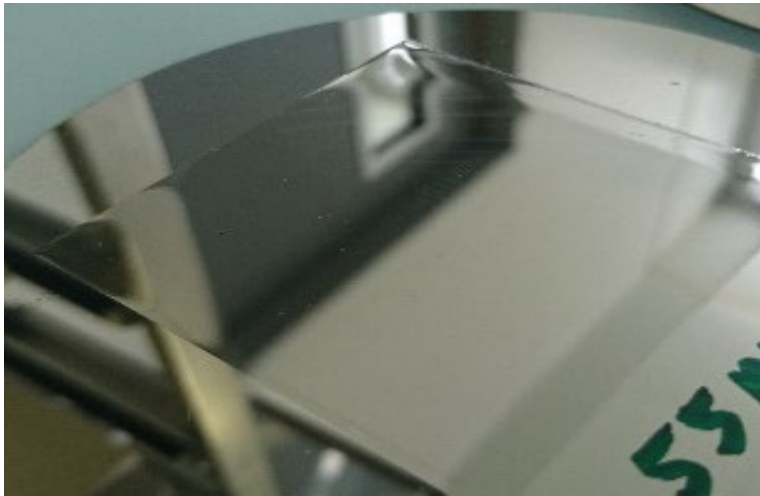
- Printing quality





# Typical ink-jet coating tests

- Printing quality – 1L

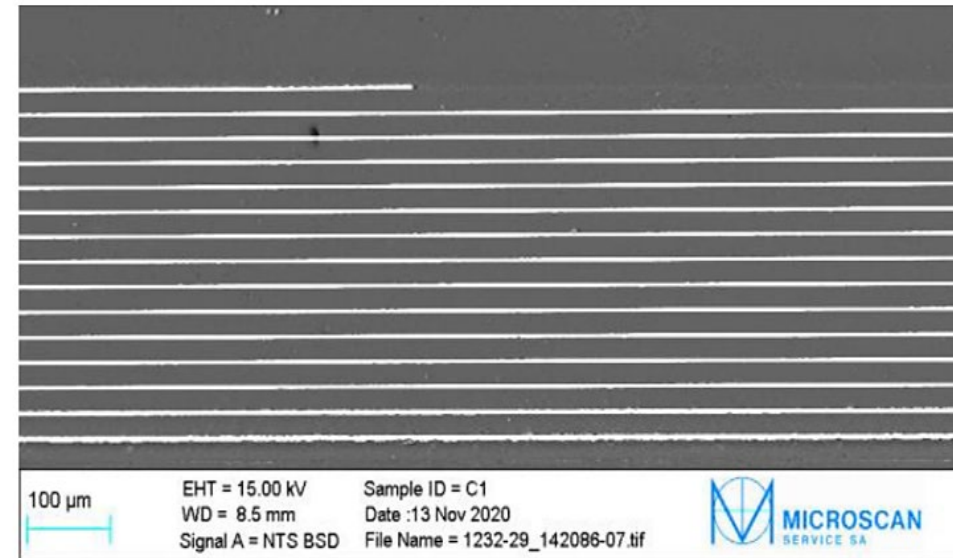
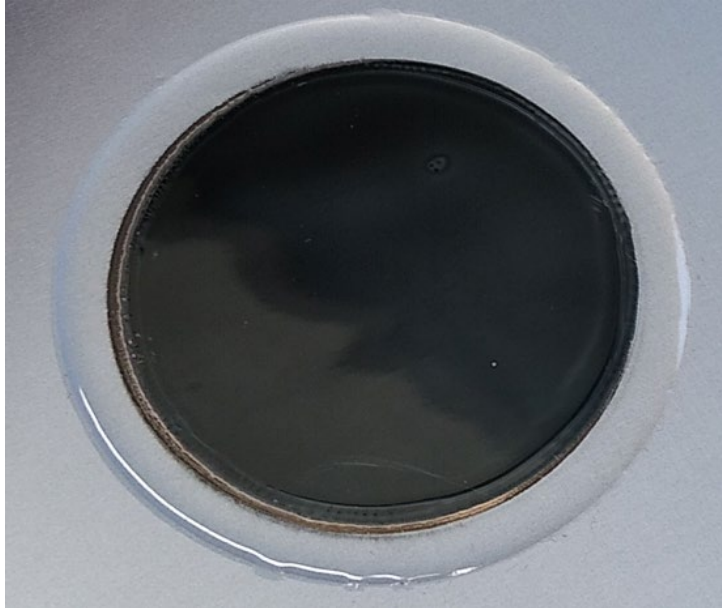


Tests usually designed for 1 layer

Multilayer coating ?

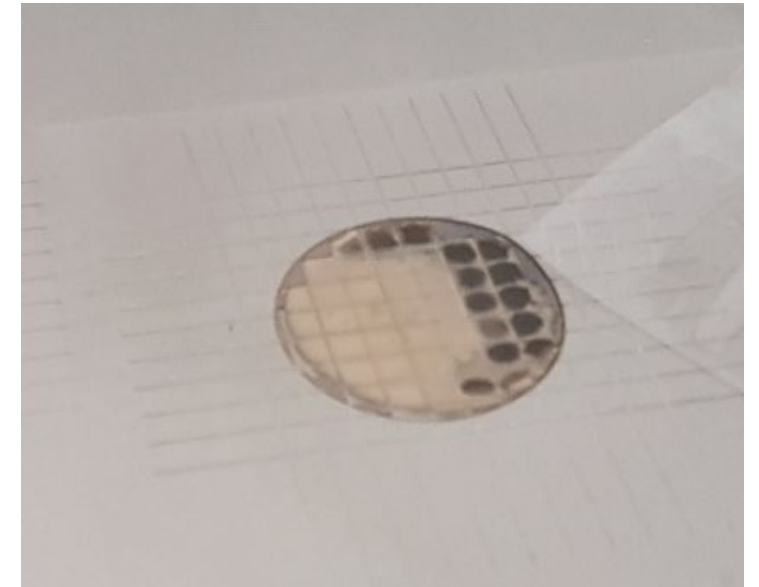
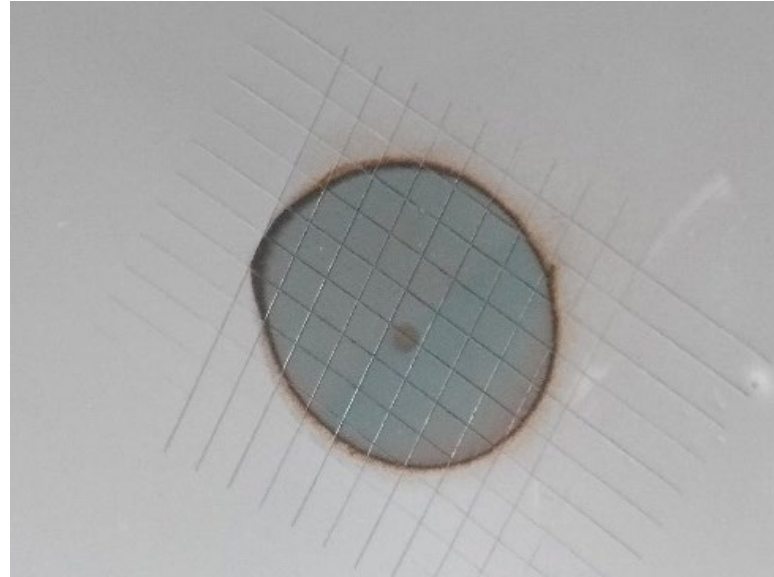
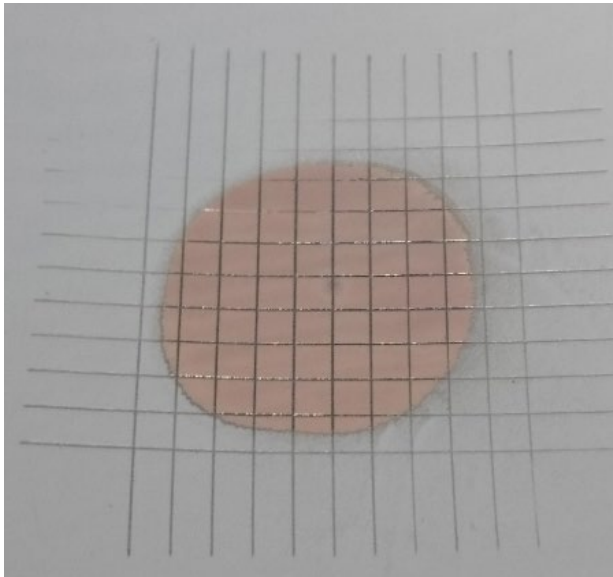
# Ink-jet printed multilayers

- Curing optimization → Successfully printed multilayered samples



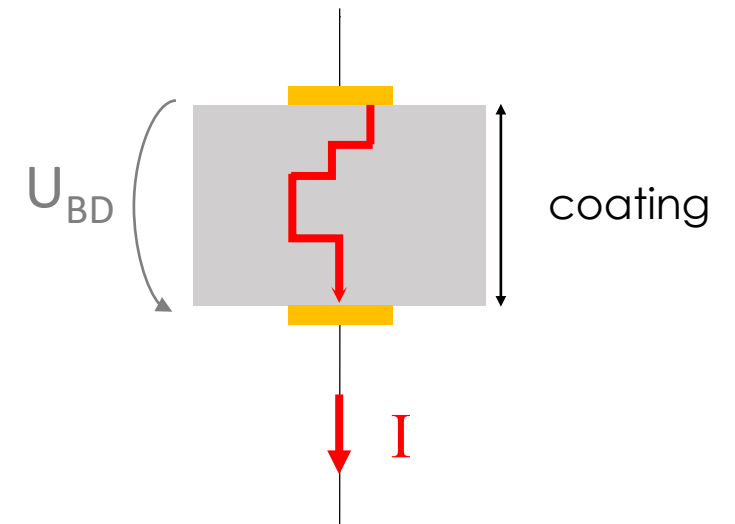
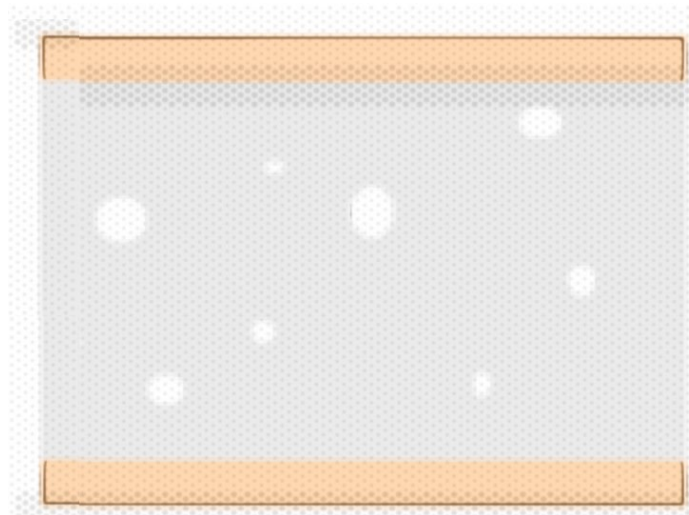
# Testing multilayered coatings

- Adhesion tests



# Testing multilayered coatings

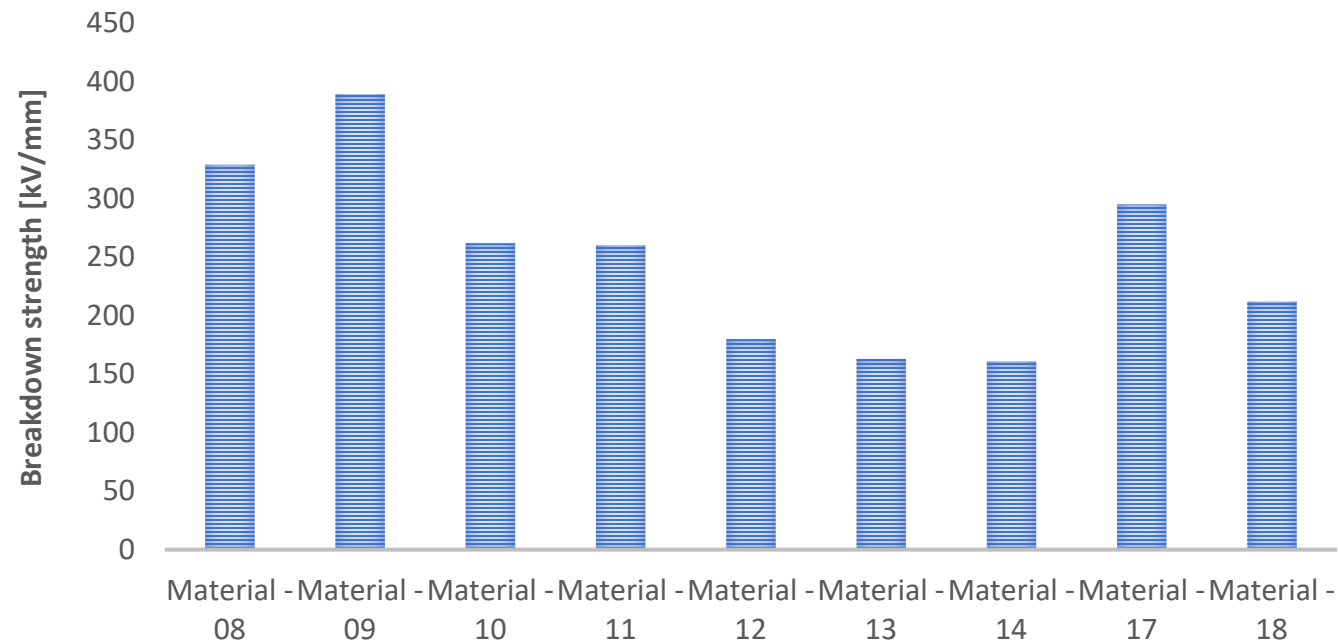
- Dielectric breakdown strength measurement



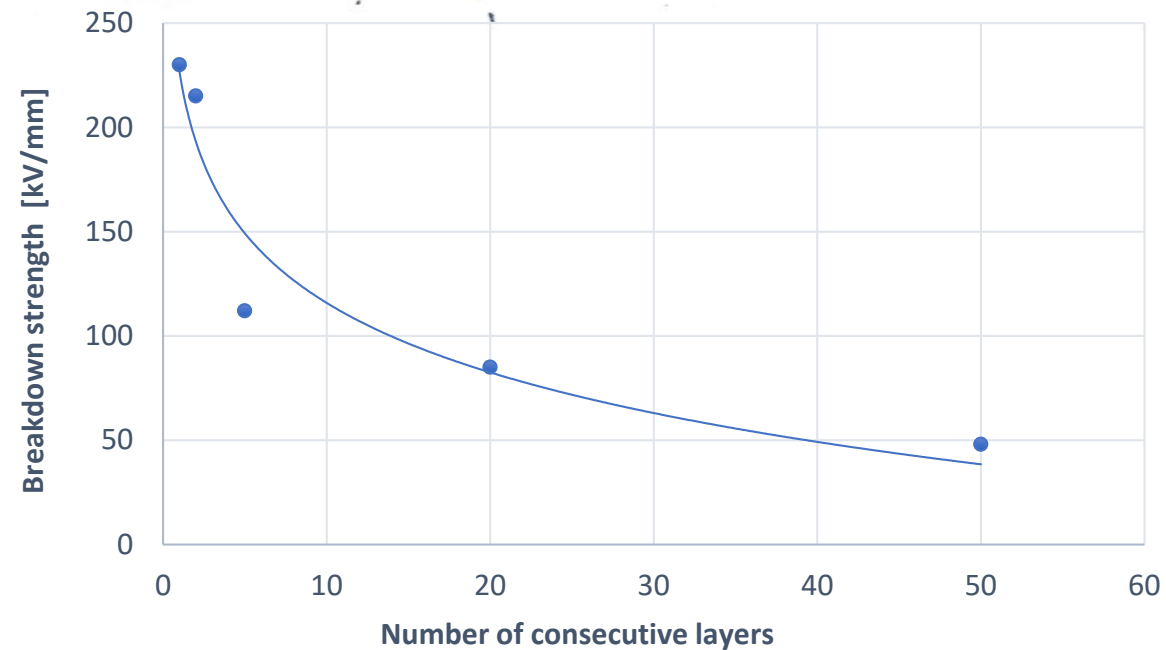


# Testing multilayered coatings

- Dielectric breakdown strength results



# Testing multilayered coatings



- Non-linear DC breakdown strength decrease with the number of layers

# Take home message

- Ink-jet printing can be used for printing thicker coatings
- Quality control : simple for single layers
- Dielectric breakdown strength can be used for multilayer coatings' QA/QC

# Contact



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