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Realization and characterization of vertical PIN diode on 100 diamond

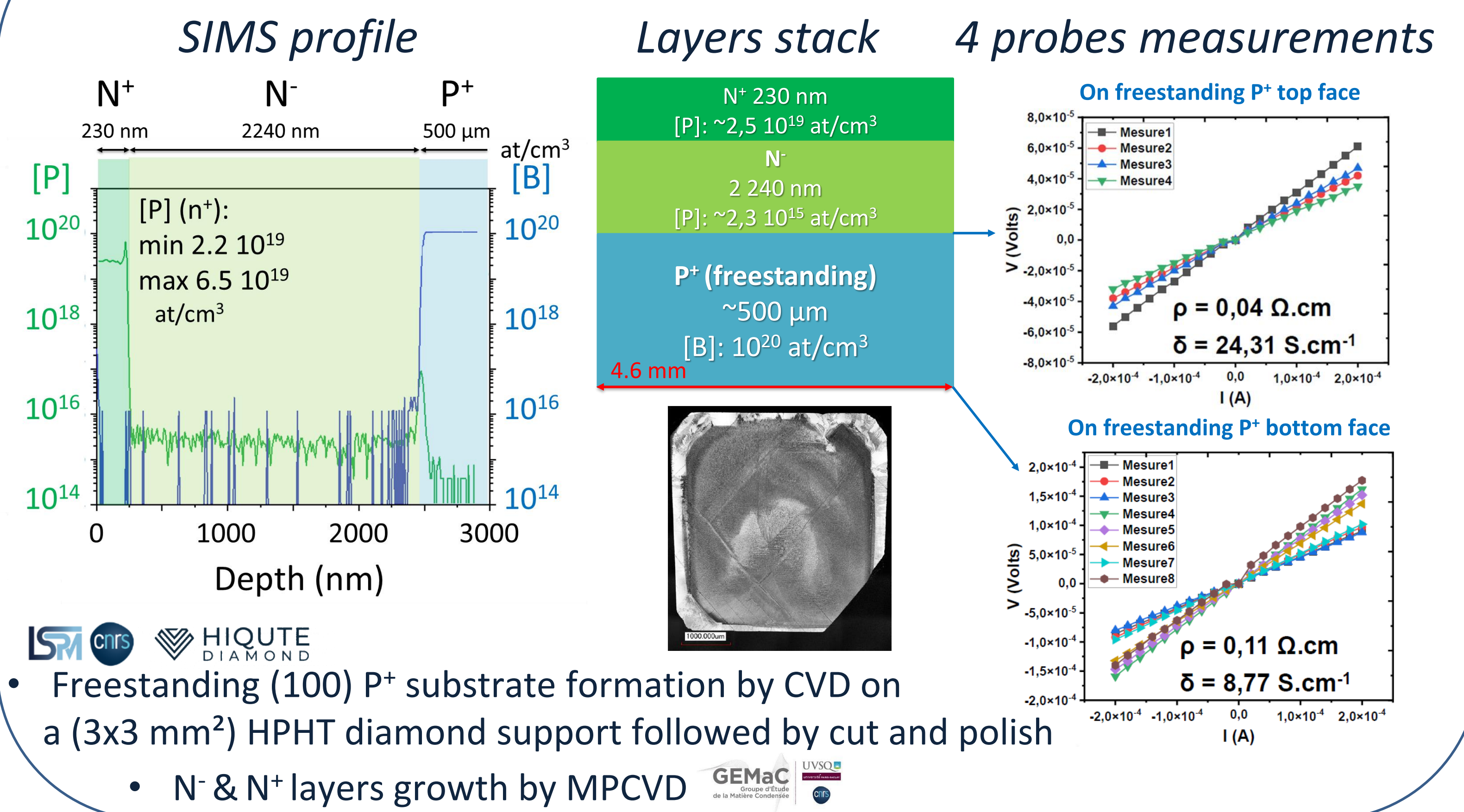
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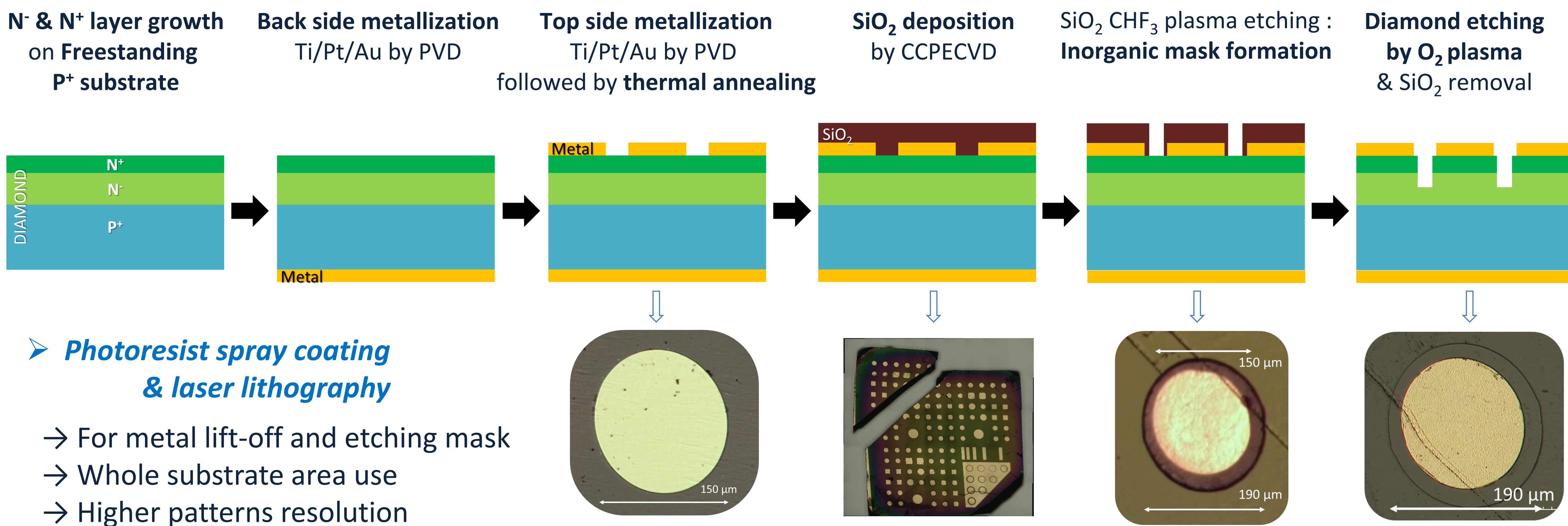
Objectives

- Fabrication of the 1st high voltage vertical (100) PIN diodes on diamond
- Manufacture of (100) freestanding heavily boron doped layer (P⁺) with low density of dislocations
- Optimisation of (100) N⁺ layer growth with low surface roughness.
- Mastery of microfabrication technological steps

PIN layers stack

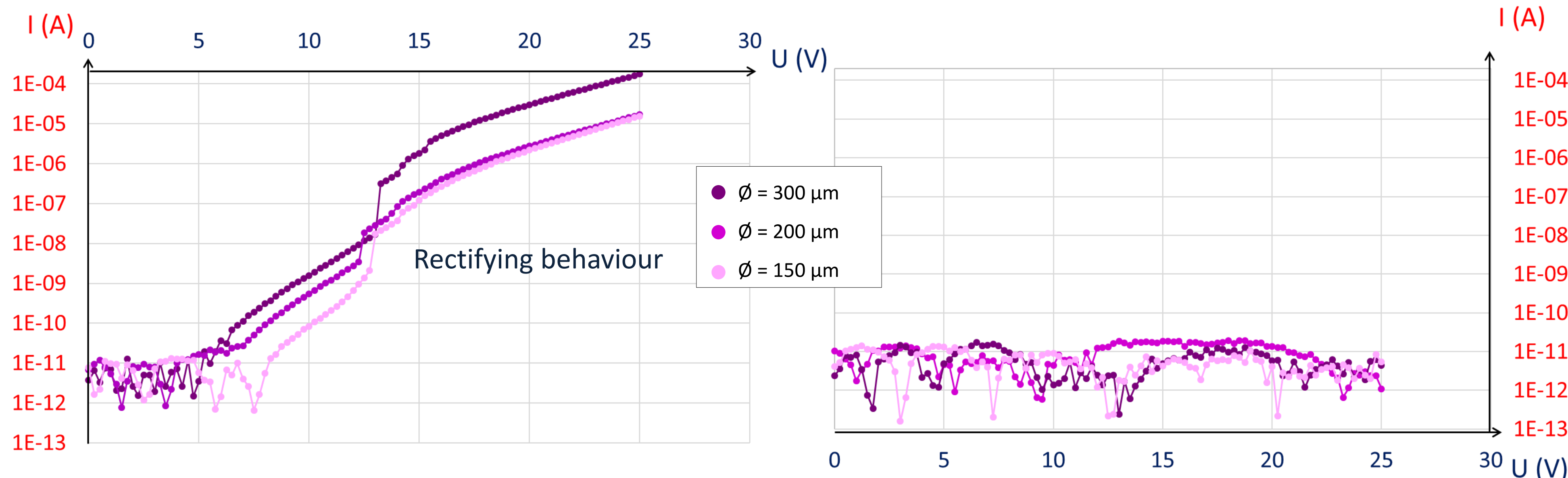


Technological key steps



Electrical characterizations

- Forward & Reverse I(V) measurements for 3 types of circular diodes



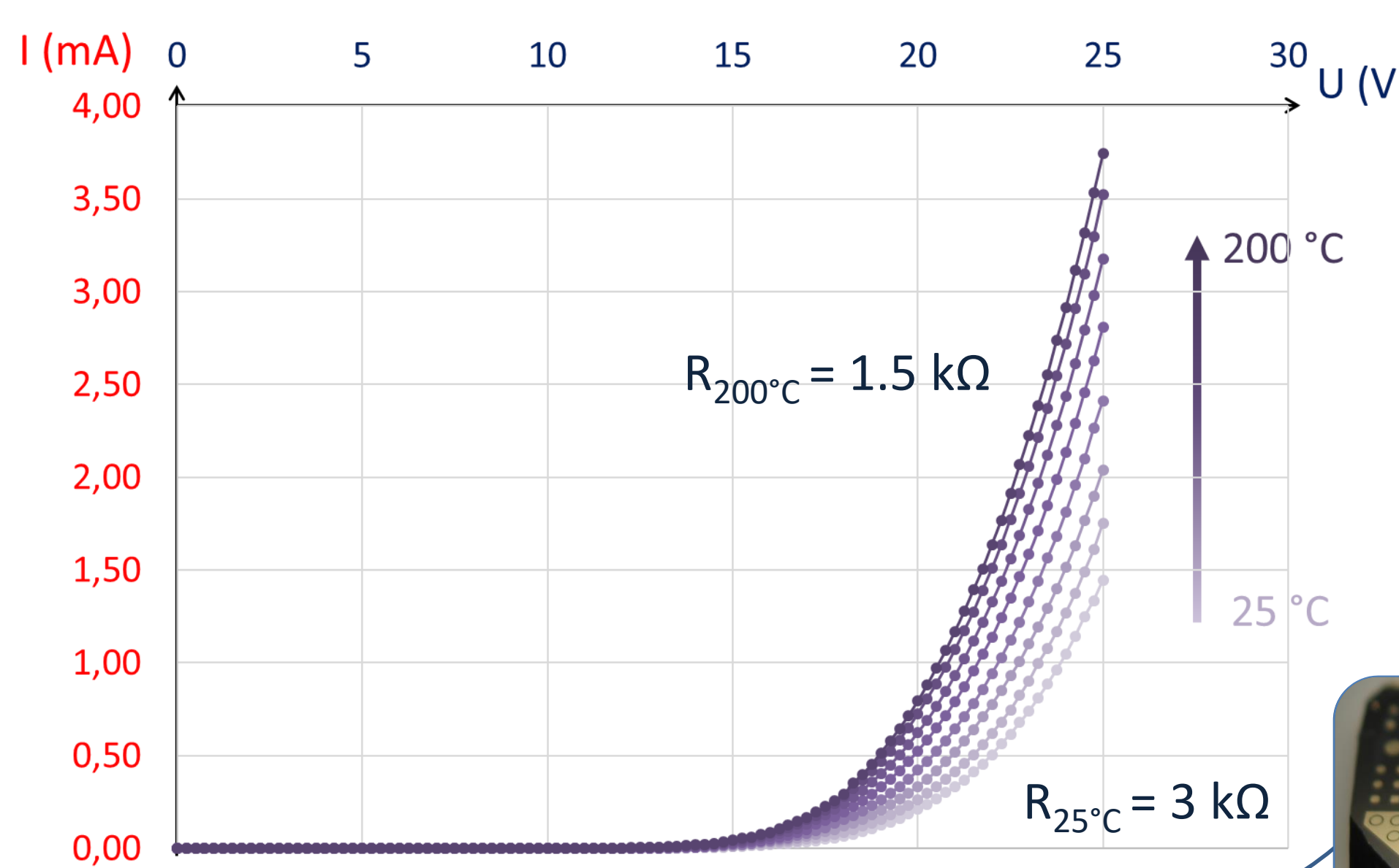
- 0,1 to 4 A/cm² @ 25 V @ RT
- V_{th} = 5 V

- Forward current @ different temperatures for a 200 μm square diode

- Low variation with temperature
- 10 A/cm² @ 200 °C

- Characterizations in progress

- ⌚ C(V) & OBIC measurements
- ⌚ High temperature measurements (T = 600 °C)



Conclusion

- ✓ A large freestanding (100) P⁺ diamond substrate (4.6 x 4.6 mm²)
- ✓ A highly doped N⁺ layer growth (2.5×10^{19} at/cm³)
- ✓ First vertical PIN (100) diode layers fully grown by MPCVD
- ✓ Vertical PIN diode functionality is demonstrated: current flowing with on and off states

To be addressed...

- TCAD simulations of the PIN diode behaviour
- Complementary electrical characterizations (TLM, OBIC, C(V))

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