

Fabrication of TiO₂ Micro-Structure by Cathodic Deposition

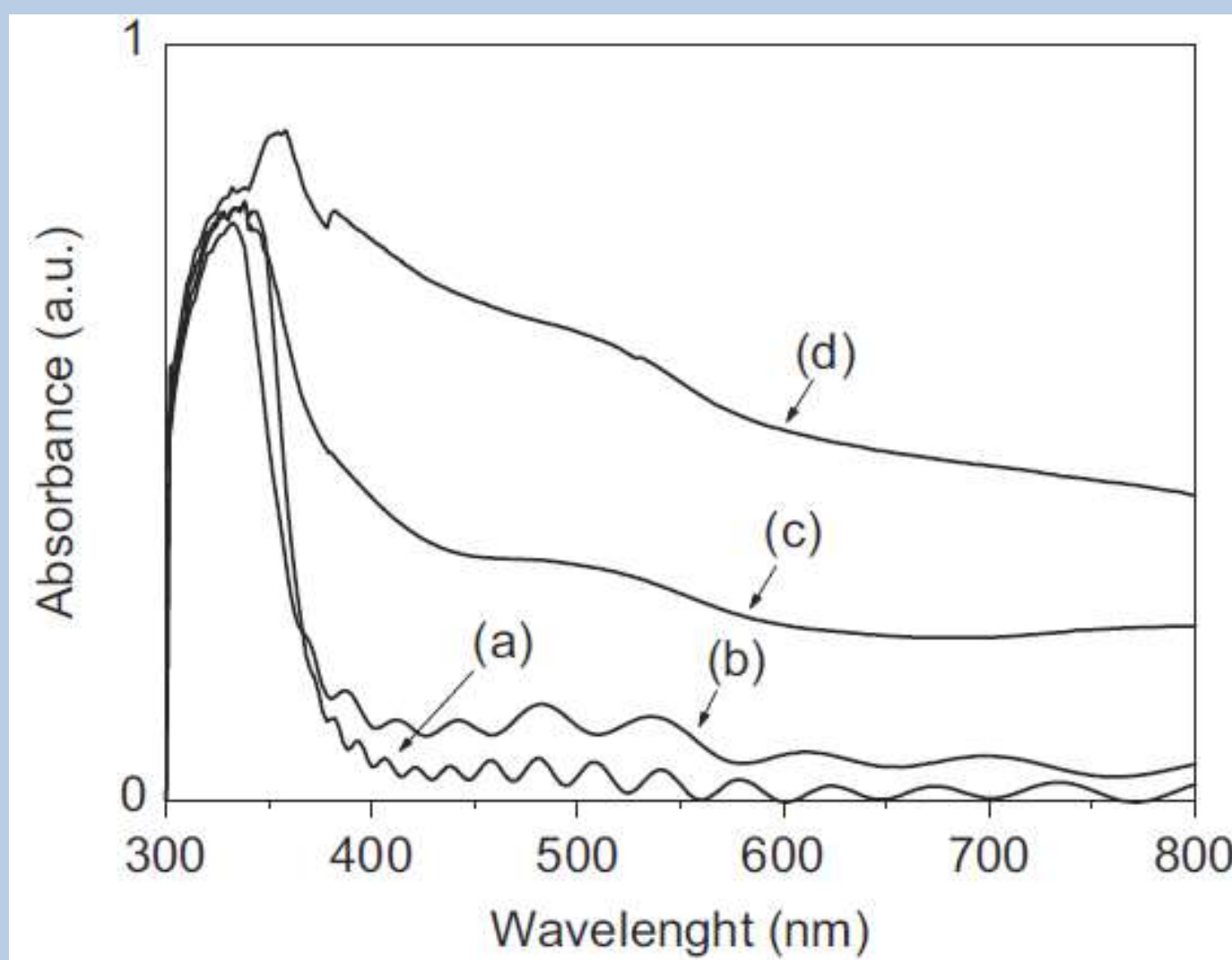
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Background

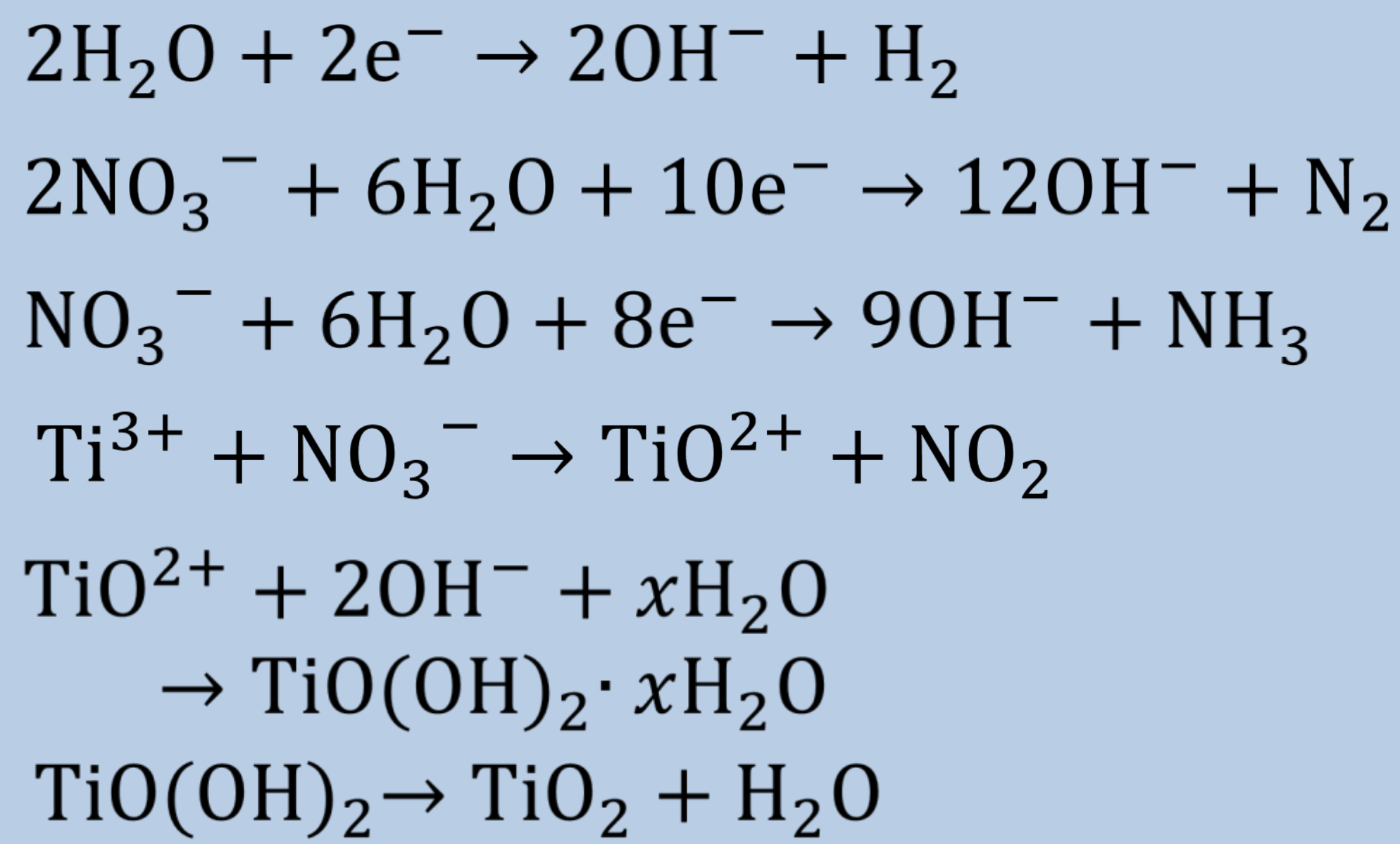
Applications of TiO₂ Micro-Structures

- **Light-extraction enhancement** in GaInN light-emitting diodes¹
- Enhancement of **I-V characteristics** and **efficiency** for dye-sensitized solar cell²

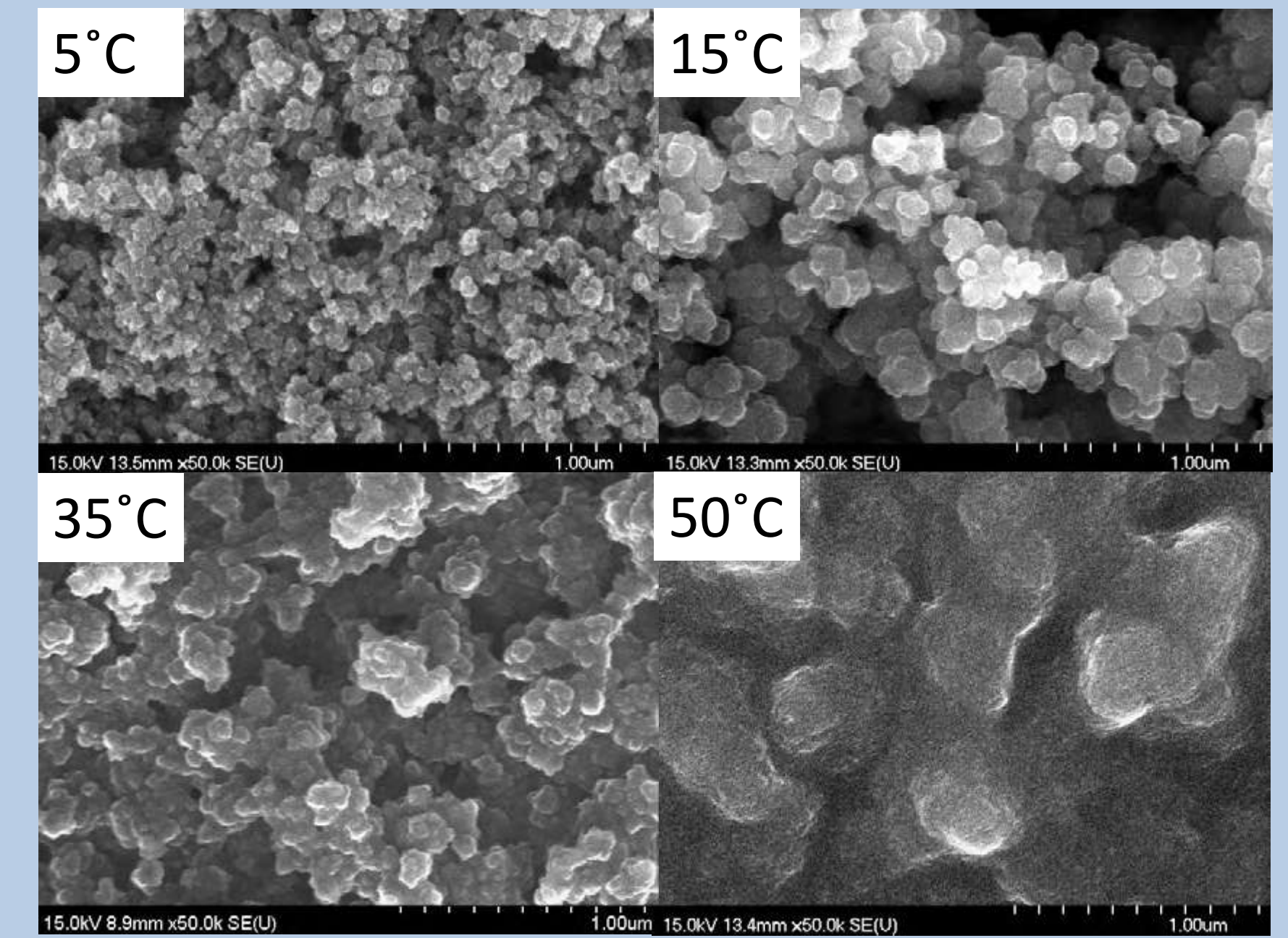


UV-vis absorption spectra of (a) TiO₂ film, (b) TiO₂ micro-structures, (c) TiO₂ film with N3 dye adsorbed, and (d) TiO₂ micro-structures with N3 dye adsorbed²

Cathodic Deposition of TiO₂



- Offers a **low-cost** yet effective process for production of TiO₂



- **Morphology control** by different experimental temperature³

Experimental Section

Fabrication procedures

- Conductive substrate
- SU-8 layer
- TiO₂

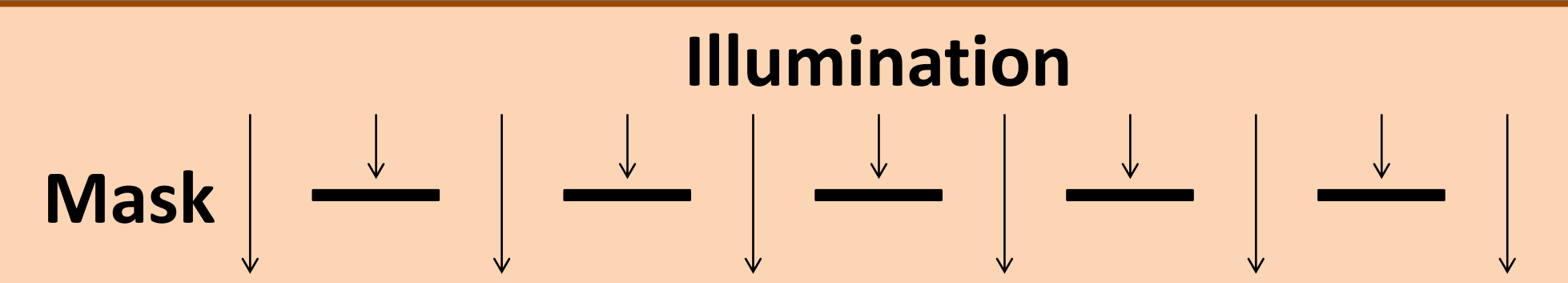
1X2 cm² Cu plate

1. Pretreatment of the substrate

- 10 wt% Ace Clean solution for 1 min
- 10 wt% HCl solution for 10 sec

2. Coat the SU-8 photoresist layer

- Pre-bake at 60 °C for 10 min
- Softbake at 80 °C for 5 min



3. Exposure at 400 mJ/cm²

- Post expose bake 1 at 65 °C for 3 min
- Post expose bake 1 at 95 °C for 6 min

5. Cathodic deposition

- 0.47 M NaCl + 25 mM TiCl₃ + 75 mM NaNO₃
- 25 mA/cm² for 5 min
- 25 °C

4. Micro-patterns formed after development

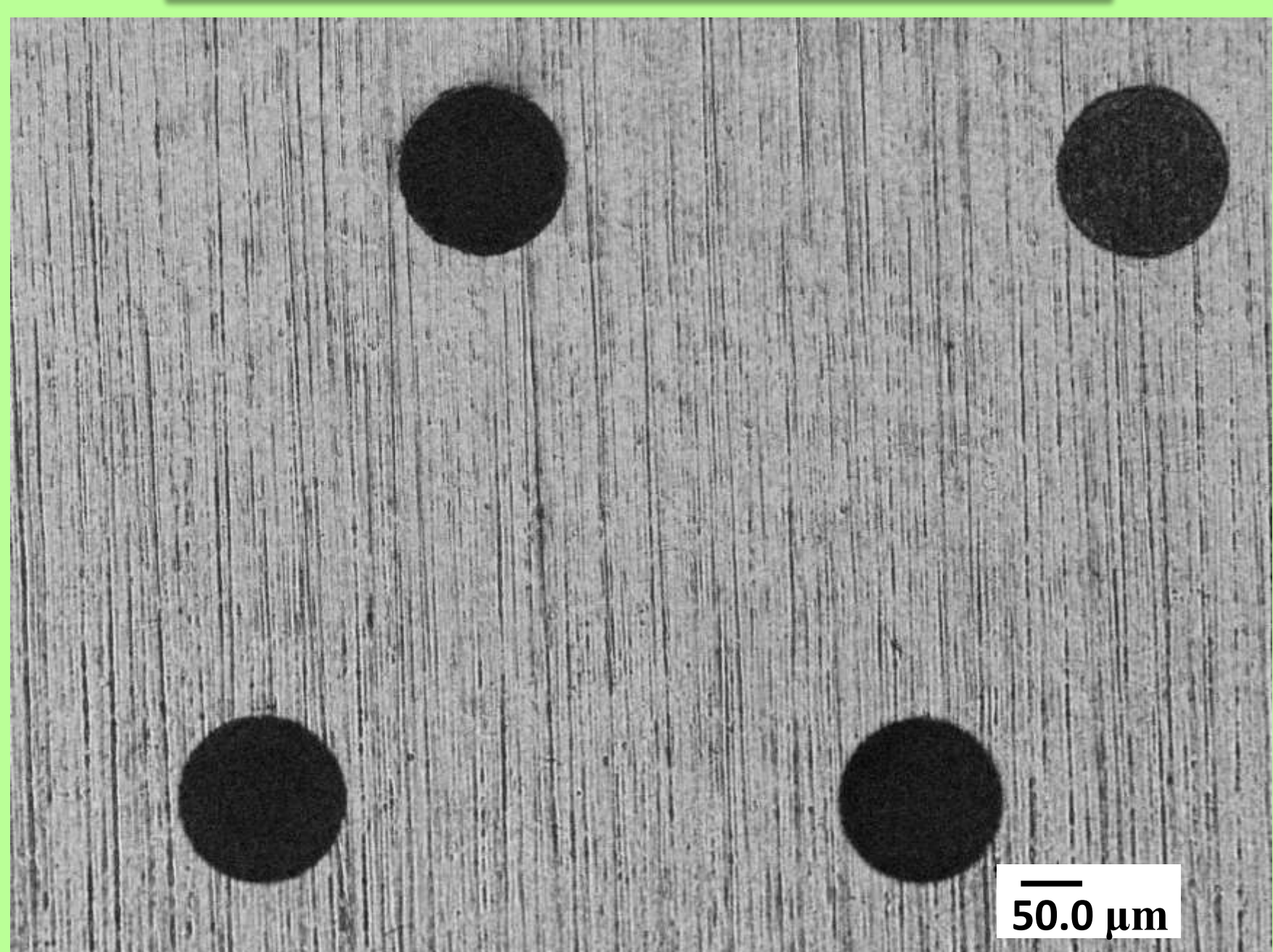
- 25 °C for 5 min

6. TiO₂ micro-structures obtained after removal of SU-8 patterns

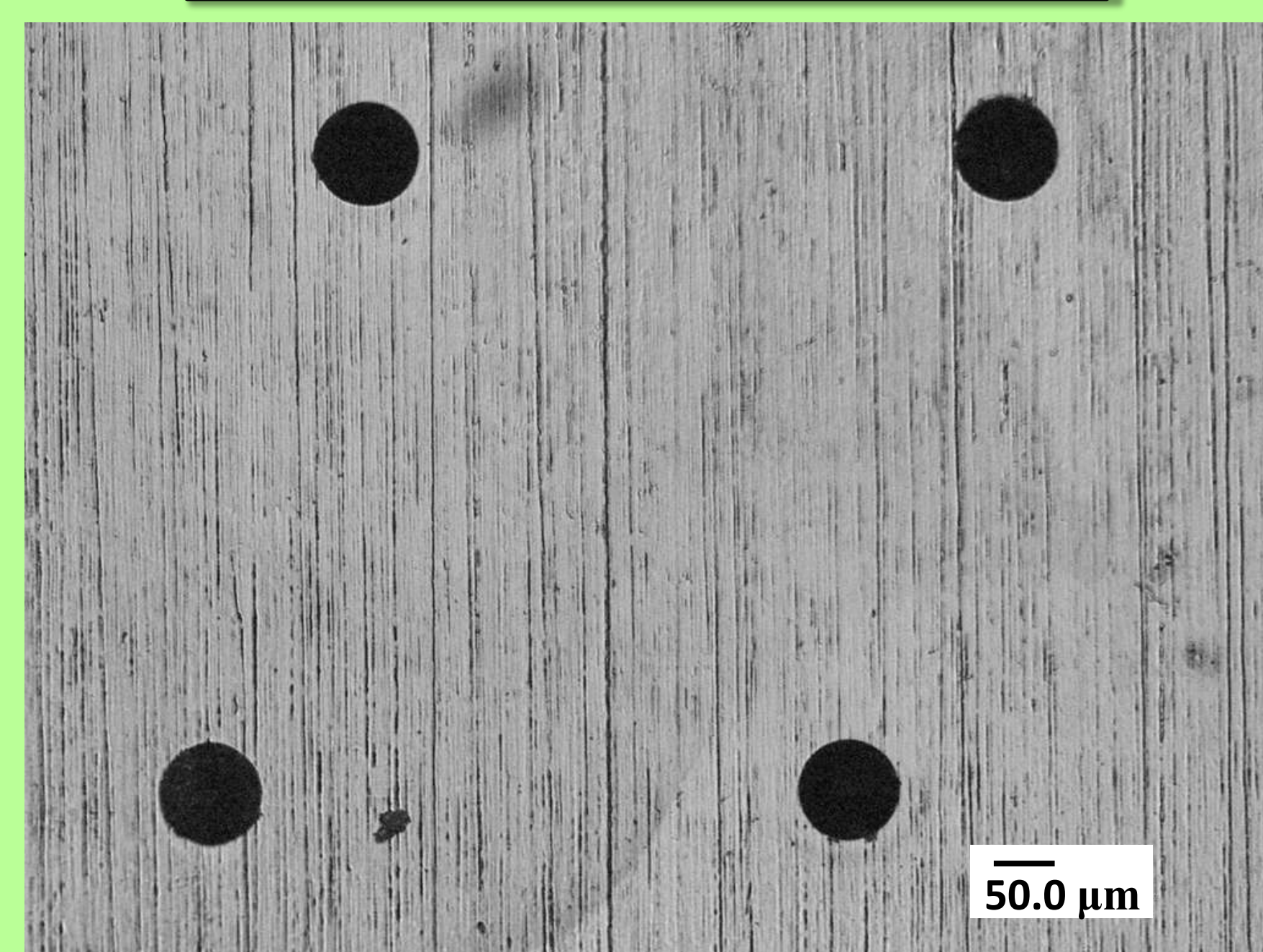
- Remover PG
- 80 °C for 10 min

Results and Discussion

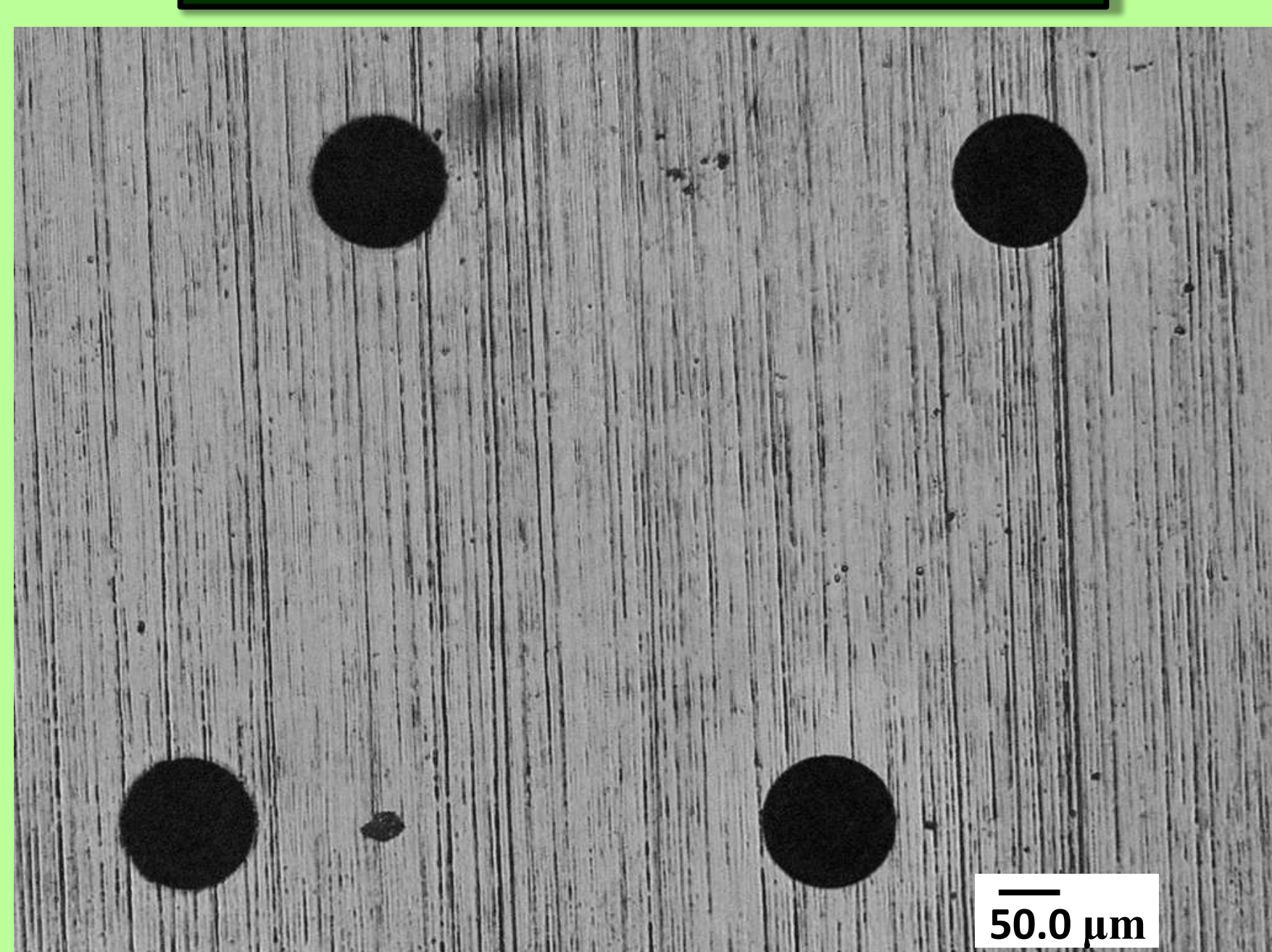
Ø125 μm TiO₂ micro-structures



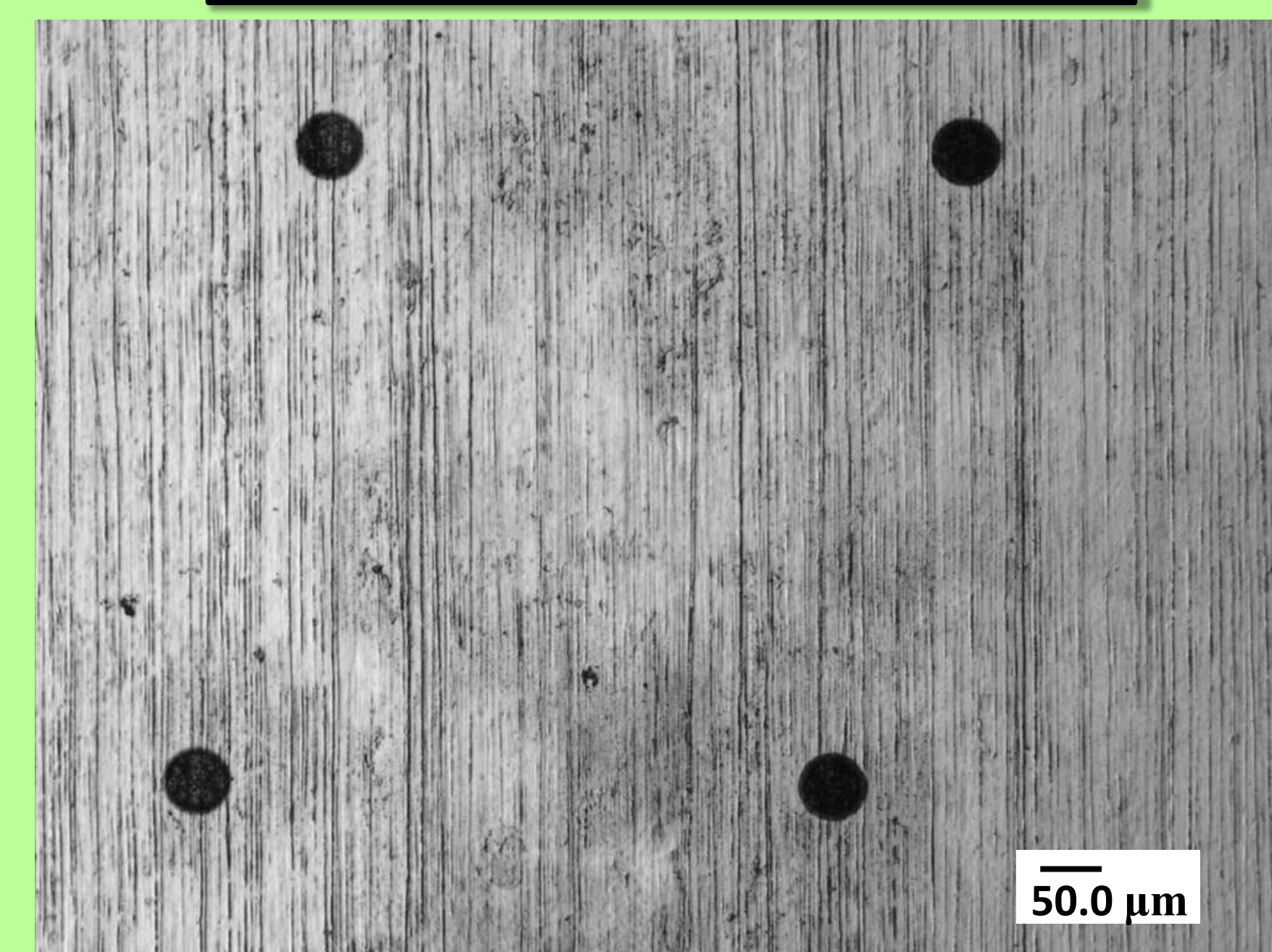
Ø75 μm TiO₂ micro-structures



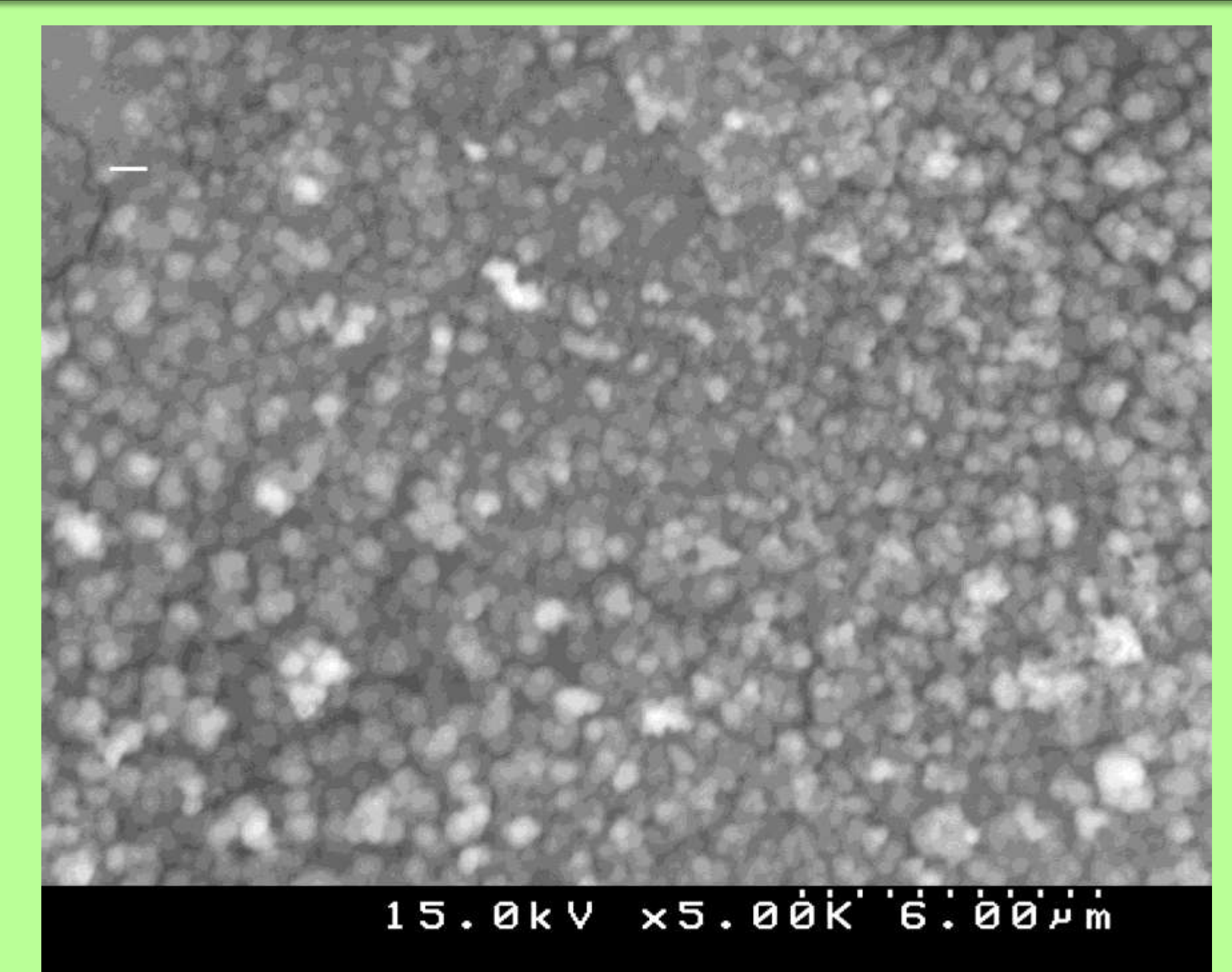
Ø100 μm TiO₂ micro-structures



Ø50 μm TiO₂ micro-structures



Surface morphology of the TiO₂ micro-structures



- Compact film with micro-scale particles

Conclusions

- TiO₂ micro-structures were successfully fabricated utilizing lithography and cathodic deposition.
- Diameter of the TiO₂ micro-structures ranged from 50-125 μm

Reference

1. Ma et al., Appl. Phys. Lett. 101 (2012) 141105.
2. Meen et al., J. Phys. Chem. Solids, 72 (2011) 653.
3. C.C.Huang et al., Electrochim. Acta 55 (2010) 7028.

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