

Platinum Electroless Plating of Silk Utilizing Supercritical Carbon Dioxide

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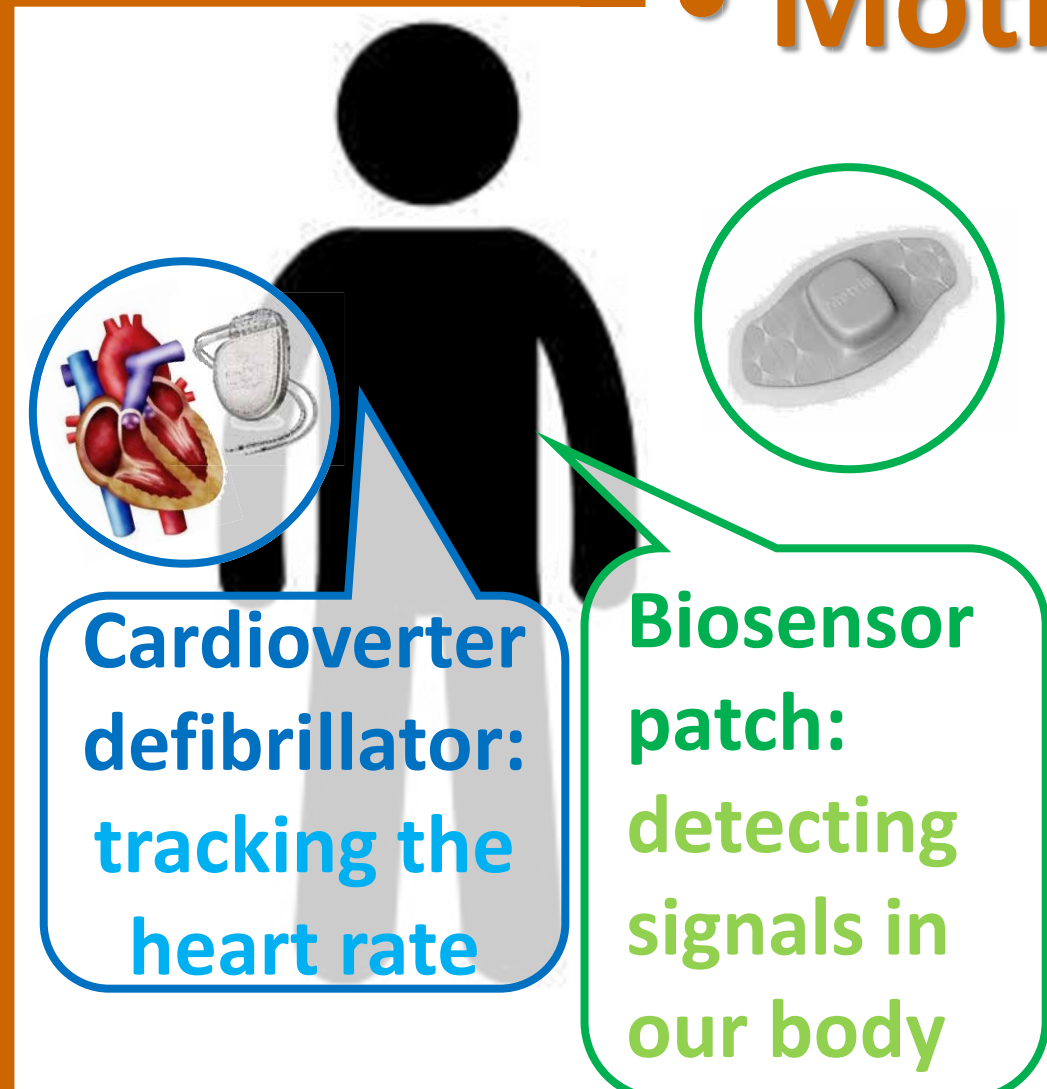
Motivation

Why platinum? Merits?

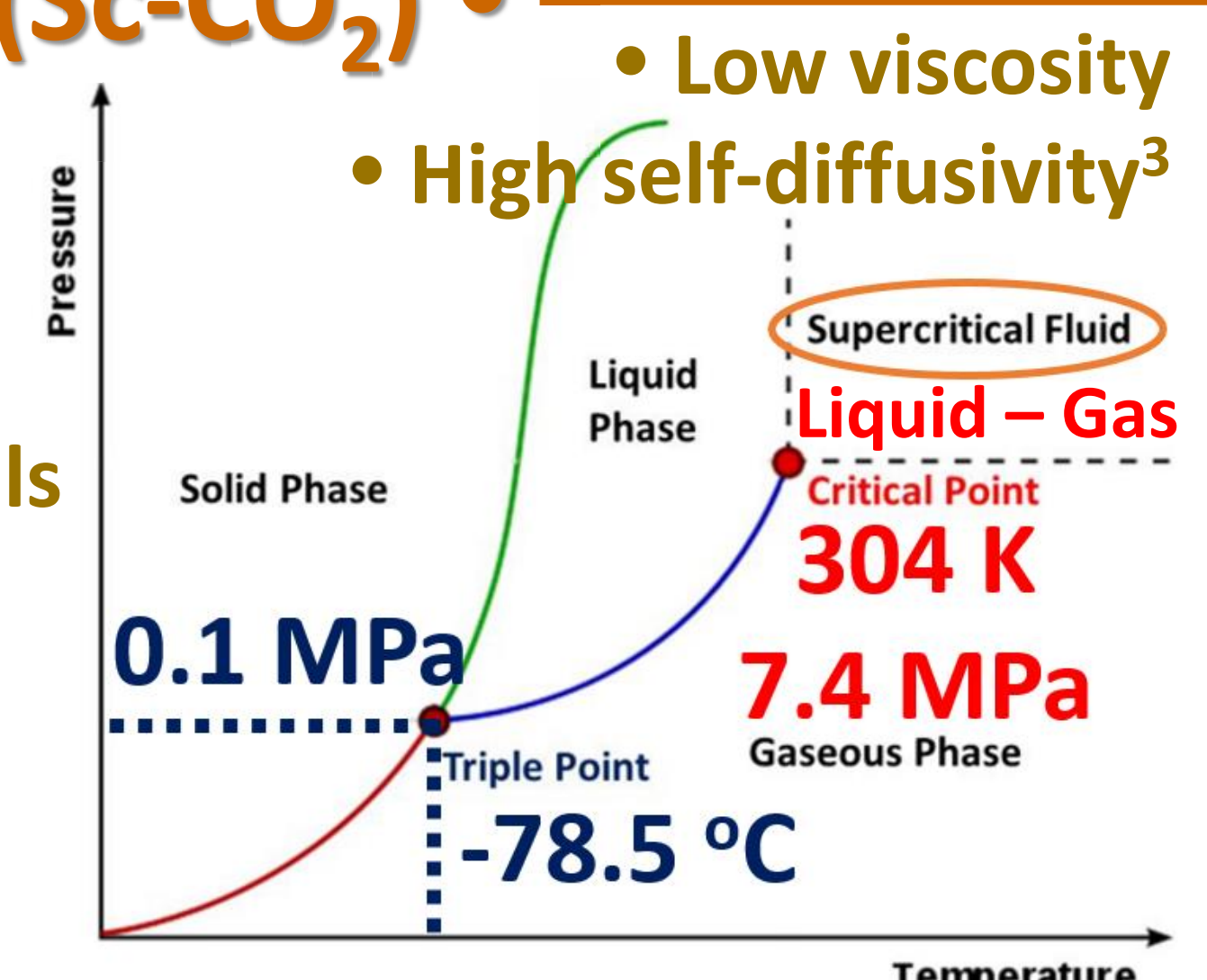
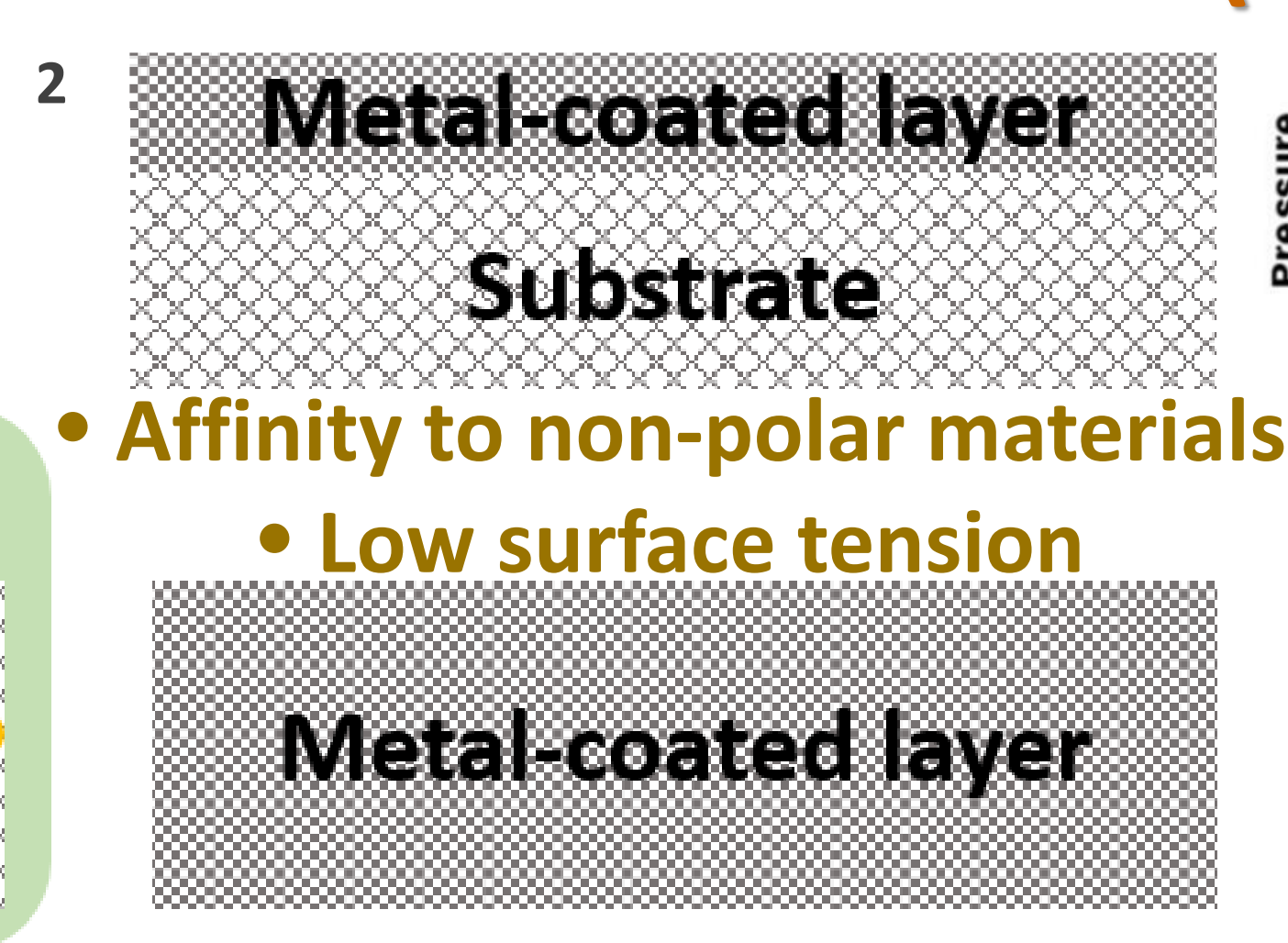
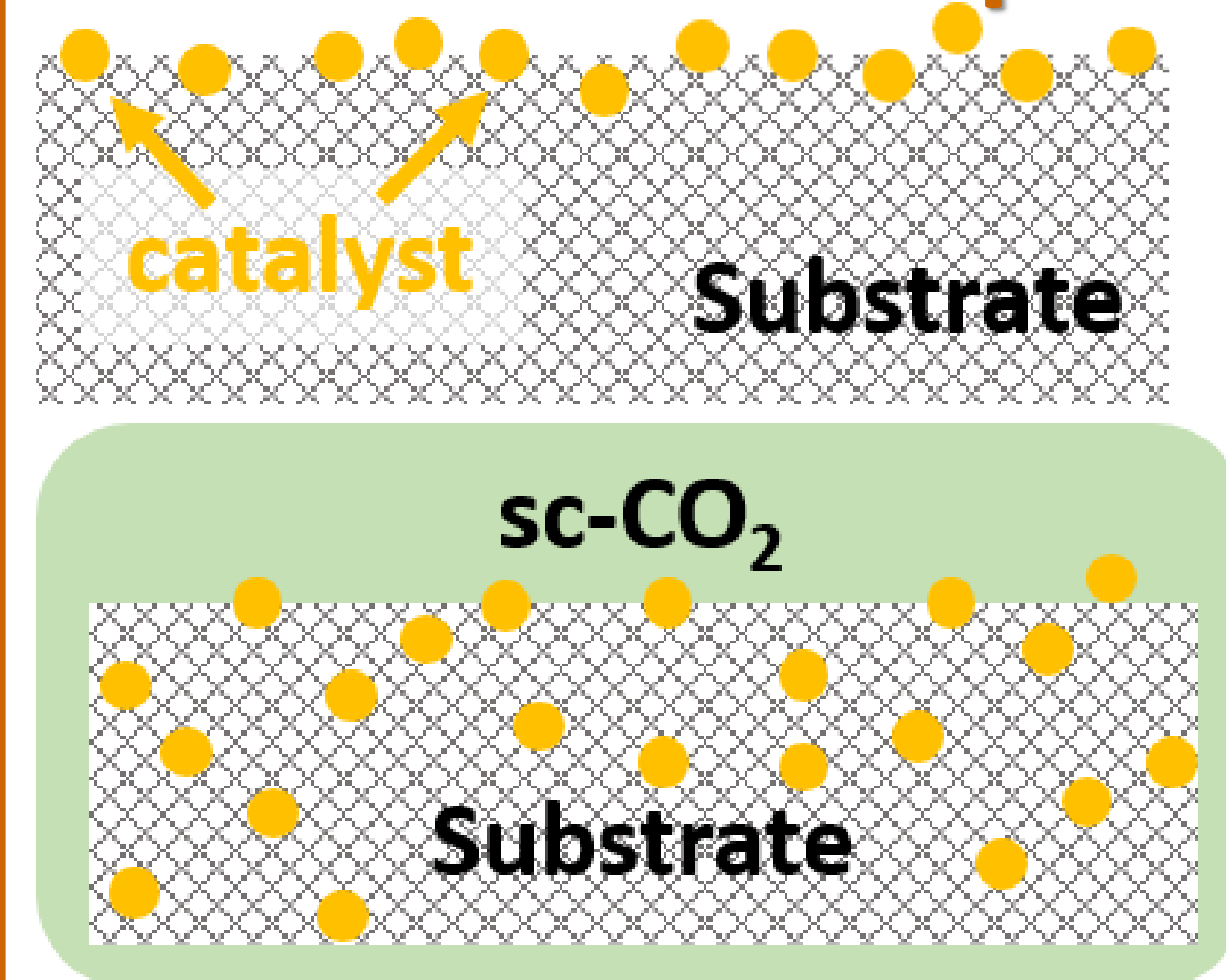
- High electrical conductivity
- High corrosion resistivity
- High biocompatibility

Why silk? Merits?

- Biocompatible
- Common cloth material



Supercritical carbon dioxide (sc-CO₂)



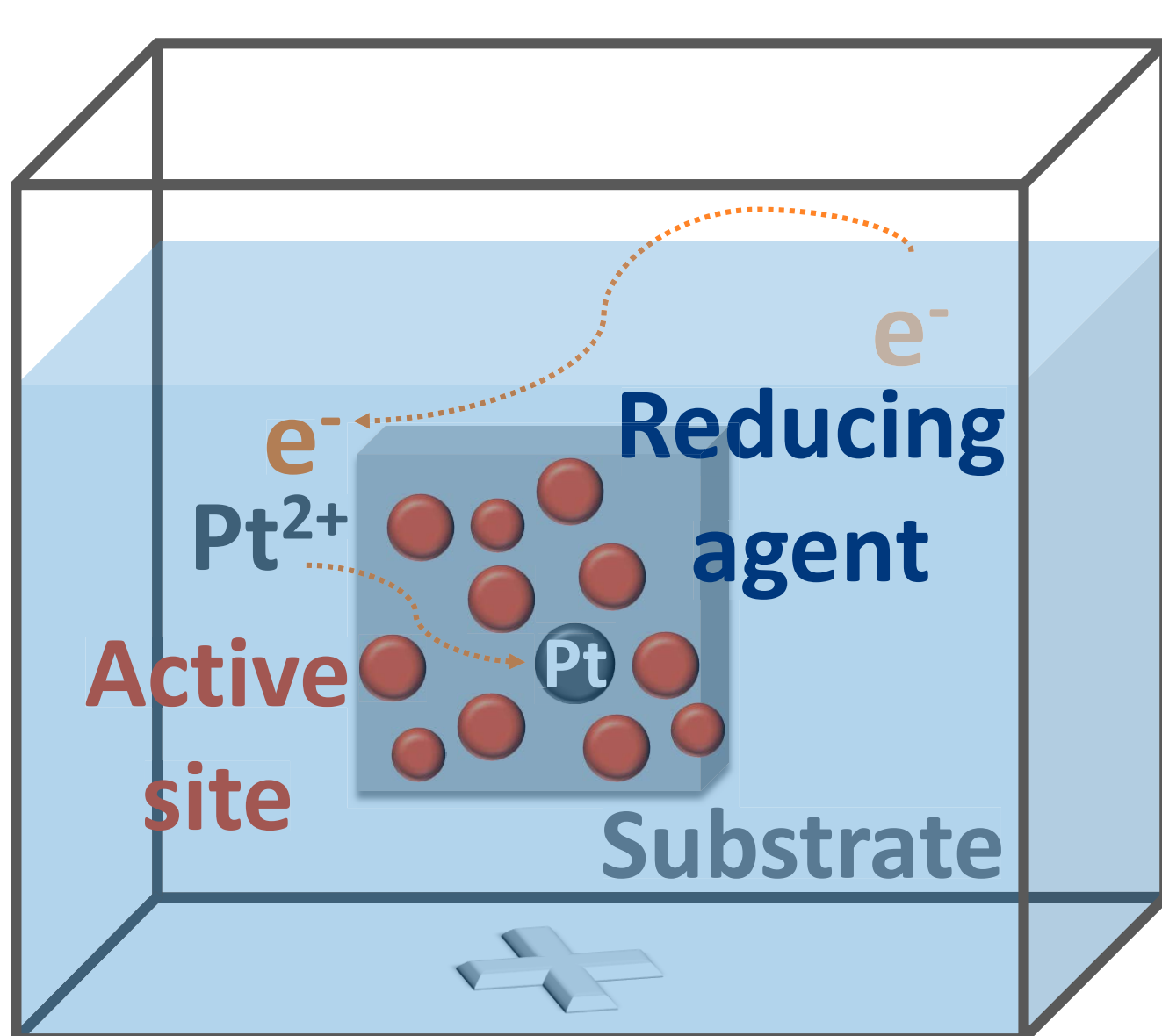
Electroless plating

-- Merits of electroless plating --

- Low process temp.
- Simple operation procedures
- Non-conductive substrate can be used
- Low cost

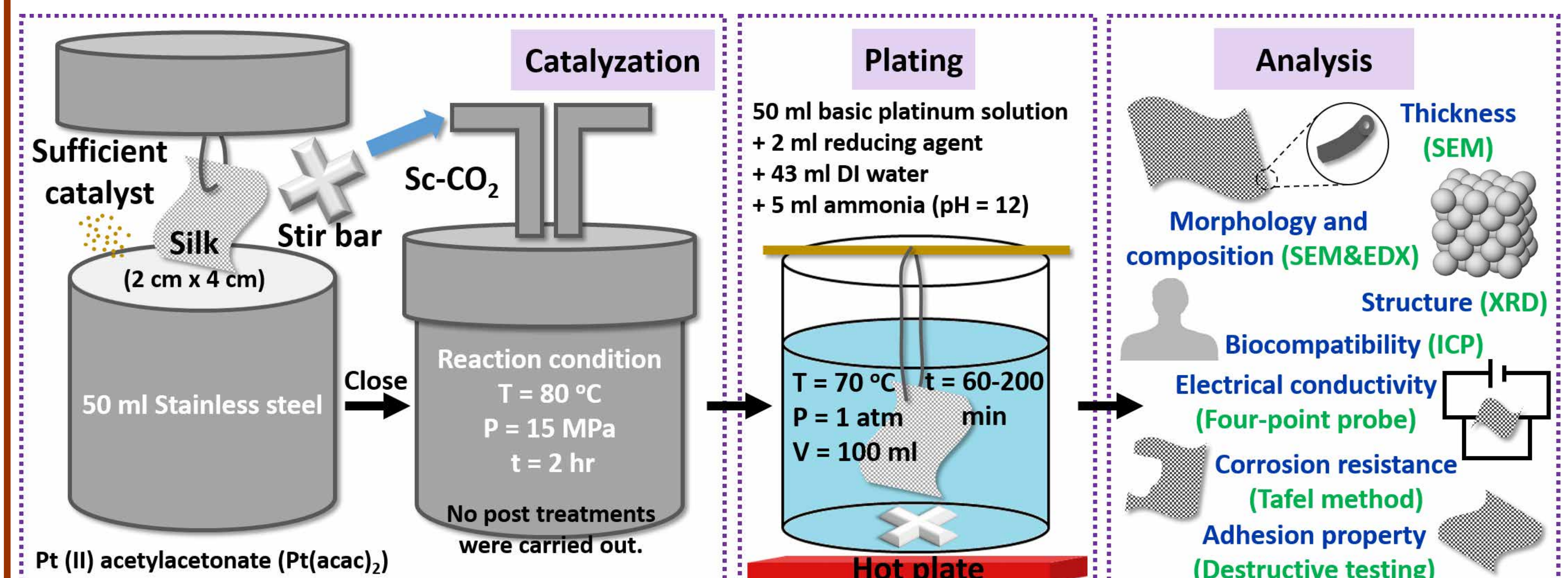
Procedures

1. Pretreatment: Clean and roughen
2. Catalyzation: Active the substrate
3. Plating: Metallize the substrate



Methodology

Pretreatment can be excluded while sc-CO₂ is introduced.



Results and discussion

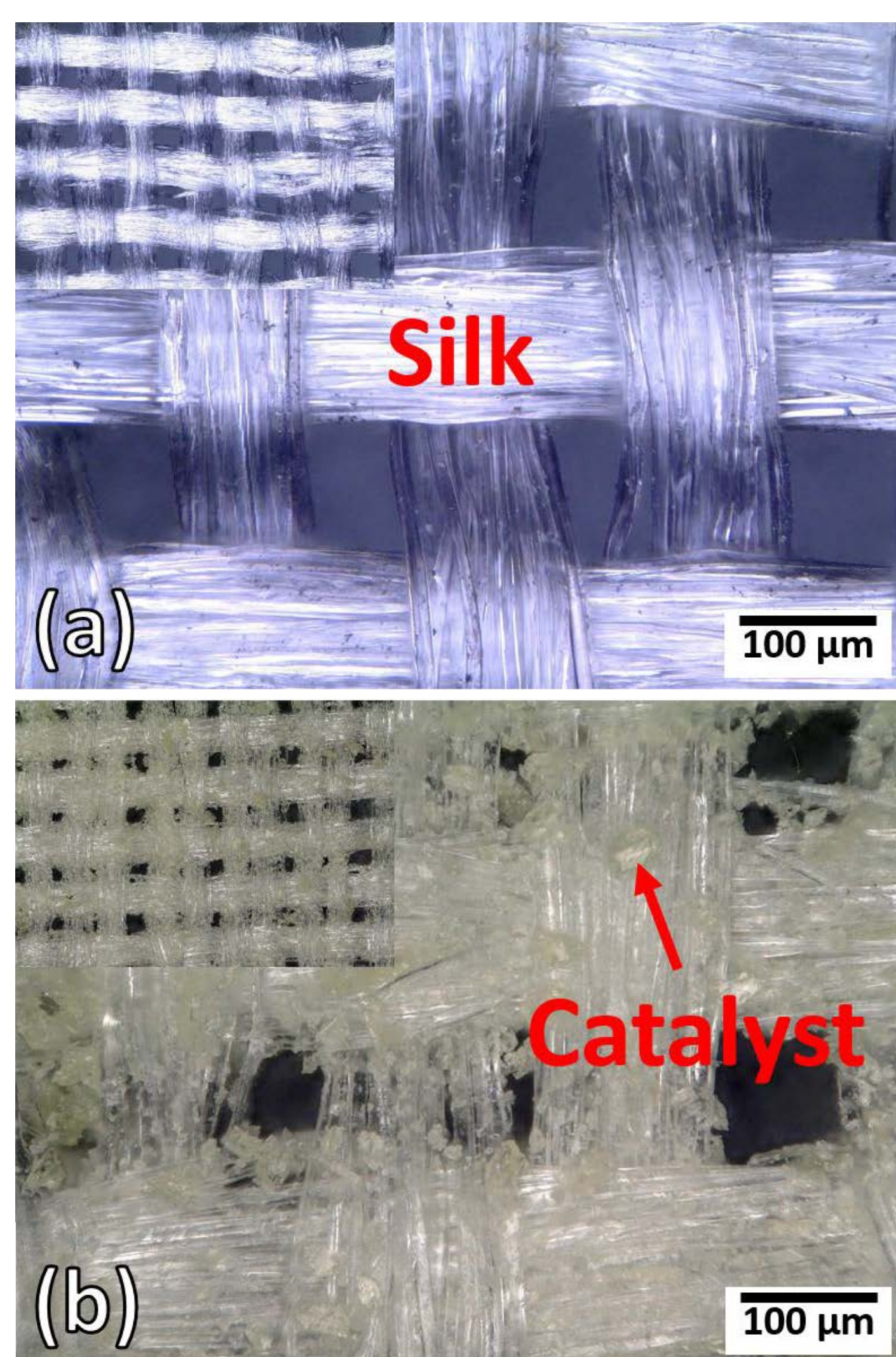


Fig.1 Morphology of (a) pure silk and (b) catalyzed silk

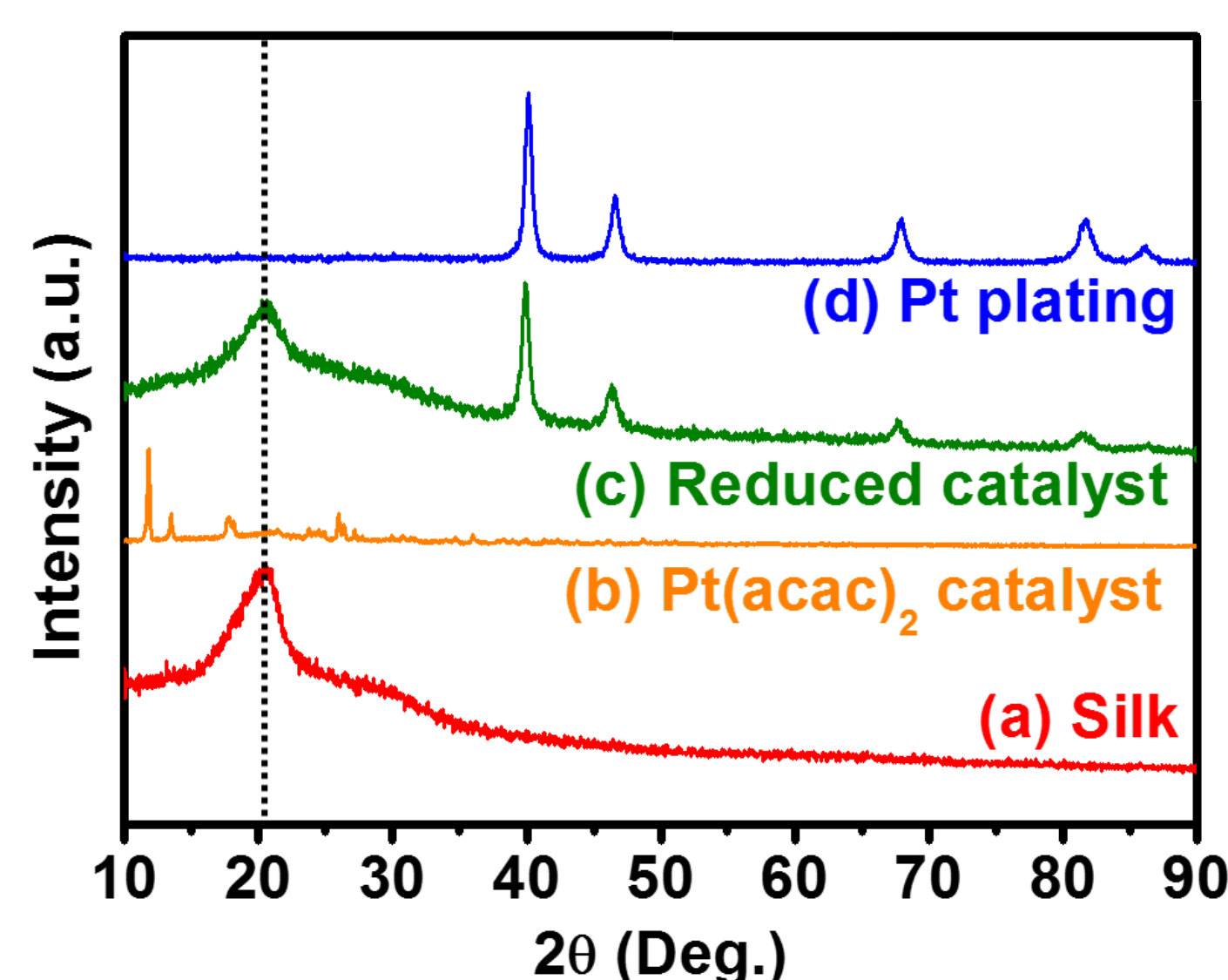


Fig. 2 X-ray diffraction pattern of Pt/silk

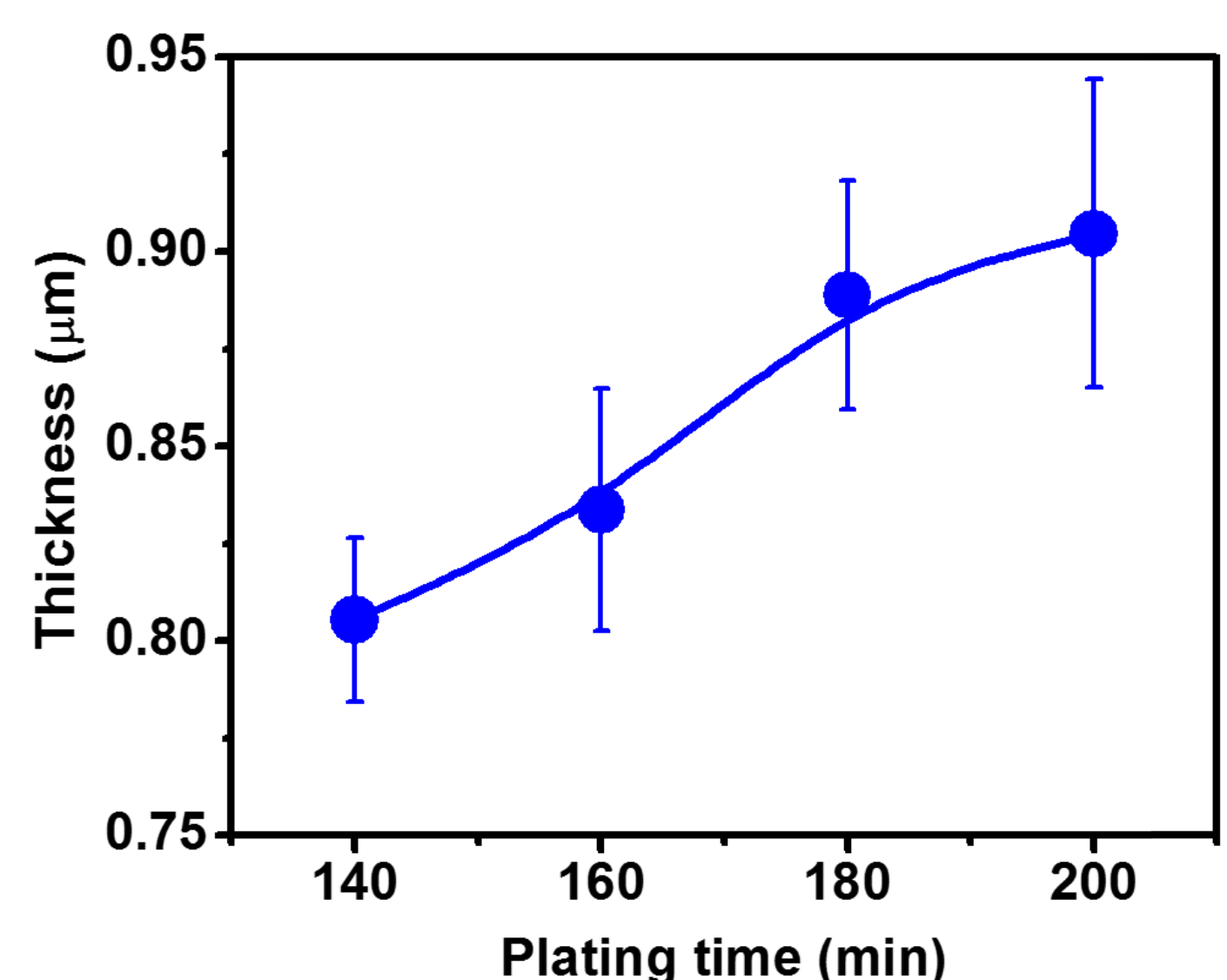


Fig. 3 Pt metallized thickness as a function of plating time duration

-----Crystal structure-----

- Five diffraction peaks can be indexed to the planes of the FCC structure of platinum.
- No other phases were found indicating pure Pt layer.

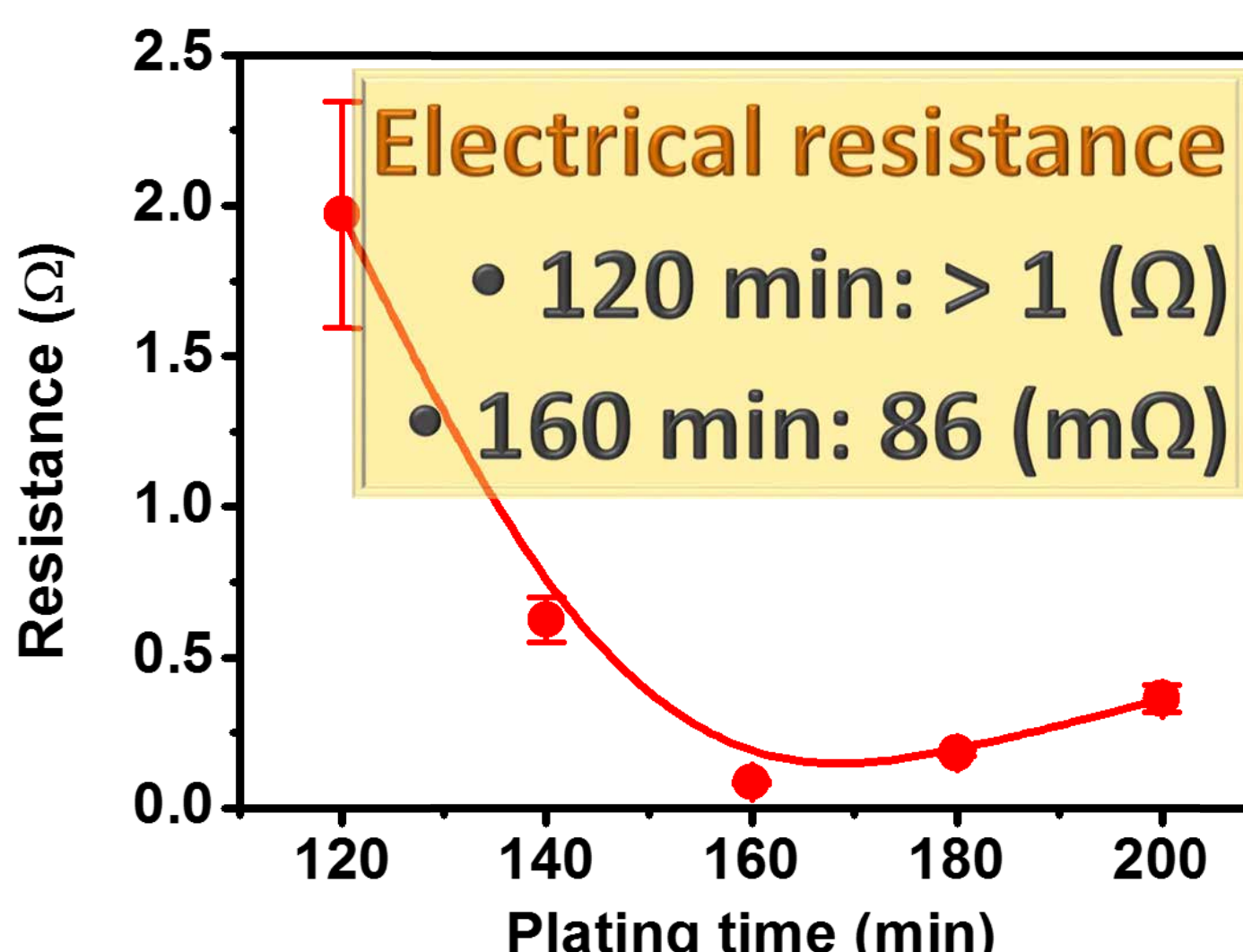


Fig. 5 Electrical resistance of Pt/silk composite

-----Pt thickness-----

- Pt metallized layer ↑ time ↑
- Maximum thickness: 0.92 μm

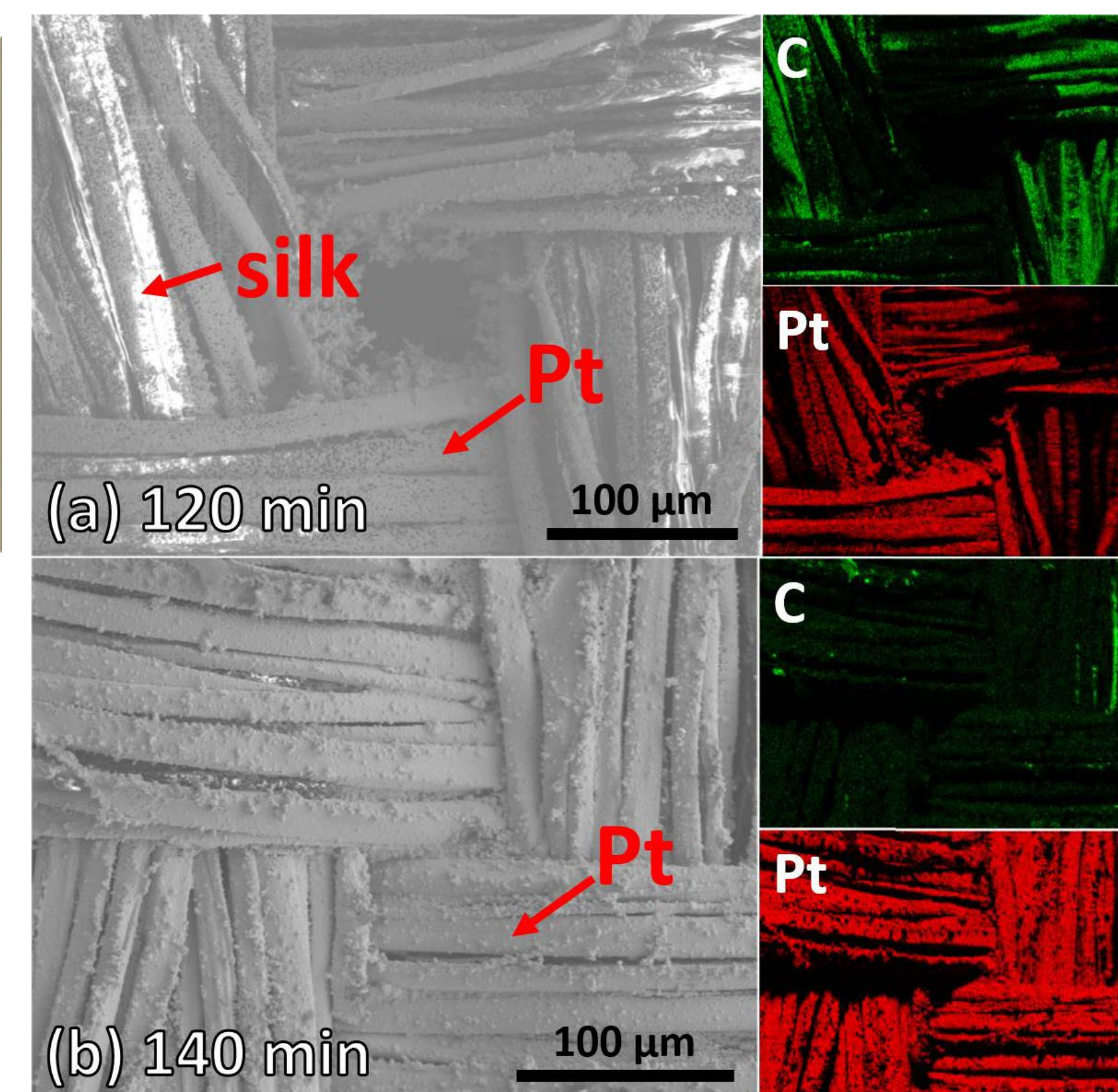


Fig. 6 Elemental mapping of Pt/silk composite

-----Morphology-----

- Pt(acac)₂ catalyst can be successfully embedded into the silk substrate without damaging the silk's structure.

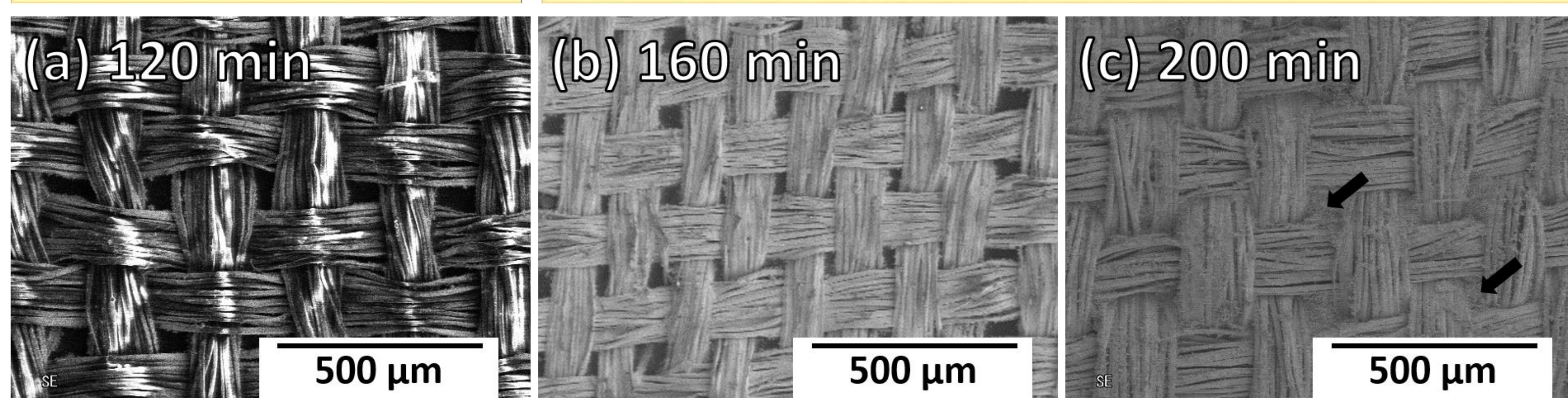


Fig. 4 Pt metallization layer at (a) 120, (b) 160, and (c) 200 min

-----Metallization Layer Coverage-----

- 120 min plating time: not fully covered by Pt metallized layer.
- 160 min plating time duration: fully metallized by Pt layer.

-----Composition-----

- Pure platinum metallization layer was plated with trace impurity.
- 120 min: Carbon signal → observed.
- 140 min: Carbon signal → low.

-----Conclusion-----

