

Large-Area Integration of Metallic Coatings on Polyimide Films Using Supercritical Carbon Dioxide

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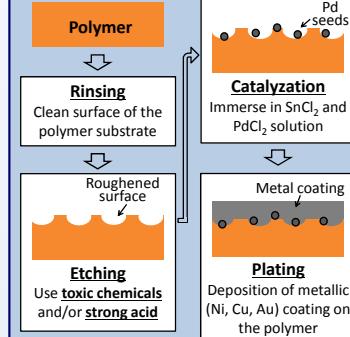
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Background

Conventional Metallization (CONV)



Challenges for CONV

Defects, Cracks, Peeling

Supercritical State

Solid, Liquid, Gas

Supercritical Fluid

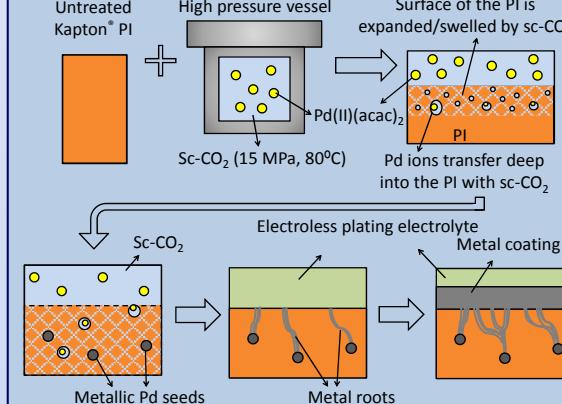
Fluid

Critical Point

Temperature

Pressure

Metallization with Supercritical CO_2



Advantages

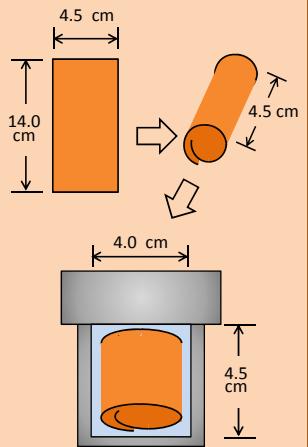
- Exclude the etching step
- High surface uniformity
- High adhesion strength

Shortcomings

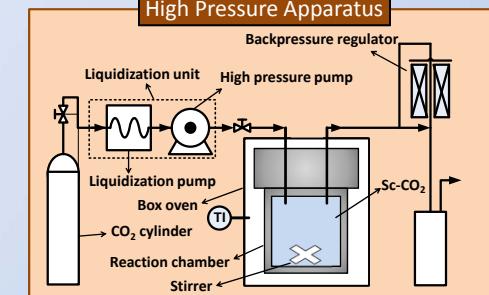
- Size of the substrates is limited by size of the high pressure vessel
- Typically 1 cm × 2 cm

Experimental Section

Catalyzation with Sc- CO_2



High Pressure Apparatus



Catalyzation Conditions

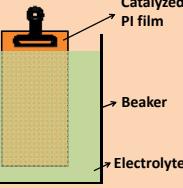
Materials

- ✓ 99.99% CO_2
- ✓ Pd(II) acetylacetone, $\text{Pd}(\text{II})(\text{acac})_2$
- ✓ Kapton® PI film

Conditions

- ✓ Pressure: 15 MPa
- ✓ Temperature: 80 °C
- ✓ Time: 60 min

Plating



Characterization

Morphology & Thickness

- ✓ FeSEM

Resistivity

- ✓ Four Point Probes

Adhesion

✓ PosiTest® Pull-Off Adhesion Tester

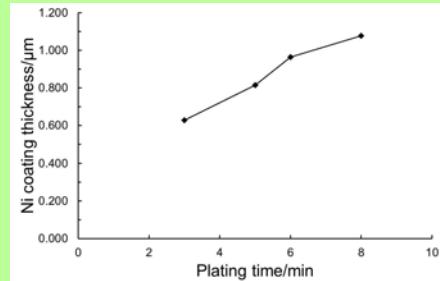


Results and Discussion

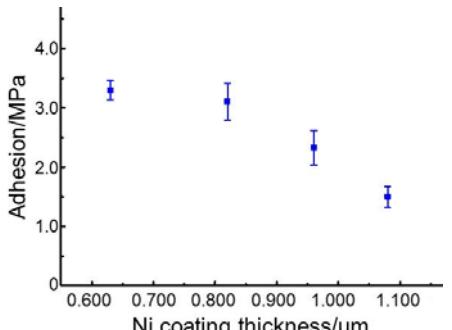
Appearance of the Film



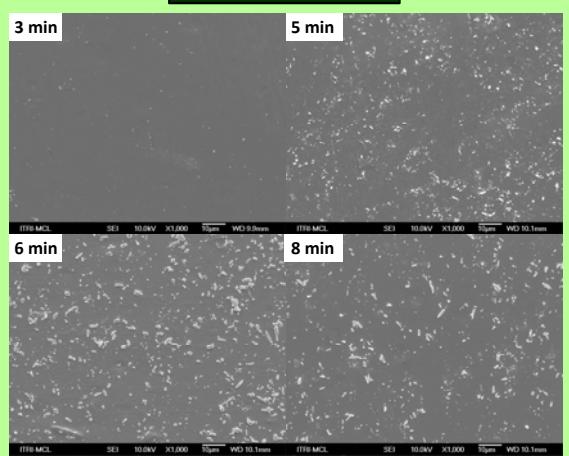
Thickness of the Ni Coatings



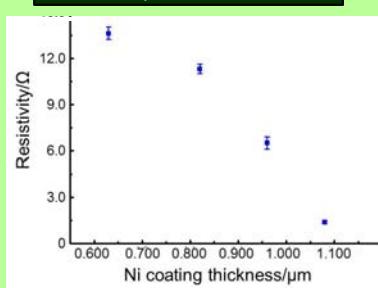
Adhesion of the Ni coatings



Surface Morphology



Resistivity of the Ni/PI films



Conclusions

- Metallization of 4.5 cm × 12 cm Kapton® PI films was realized.
- Adhesion of the Ni coating was 3.3 MPa when the thickness was 0.628 μm .

Reference

- Y. Shacham-Diamand et al., Microelectron. Eng. 132 (2015) 35–45.
- B.H. Woo et al., Microelectron. Eng. 86 (2009) 1179–1182.
- B.H. Woo et al., Surf. Coat. Technol. 209 (2009) 1971–1978.

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