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Electrophoretic Deposition of Primary Coat onto Investment Casting Wax Patterns

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Project Objectives

- **Investment Casting Ceramic Shell build-up:**
  - **Replace primary dip-coating step with one using electrophoretic deposition (EPD)**
  - REASONING
  - **Colloidal processing technique**
  - **High microstructural uniformity in deposit**
  - **Low viscosity suspensions**
  - **Coating infiltration into more complex geometries**
  - ULTIMATE GOAL
  - **“To produce a higher quality primary shell coating on both external and internal pattern surfaces”**

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Electrophoretic Deposition (EPD)

Particles in suspending medium:

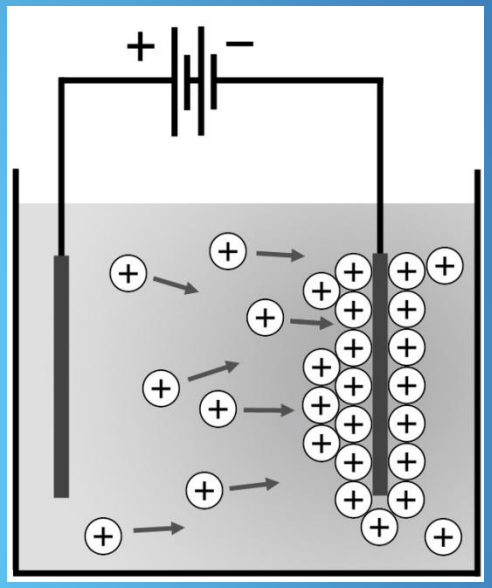
- gain a surface charge – electrochemical
- polarity and magnitude of charge determined by:
  - Suspension pH
  - Suspension modifiers (polyelectrolytes)

Electric field produced by electrodes in suspension:

- Movement of particles, direction determined by their charge
- Called **ELECTROPHORESIS** Stage

Particles Form adherent deposit on electrode of opposite charge:

- Called **DEPOSITION** Stage



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Outline

Integrating Electrophoretic Deposition into Investment Casting

1) Pattern Substrate

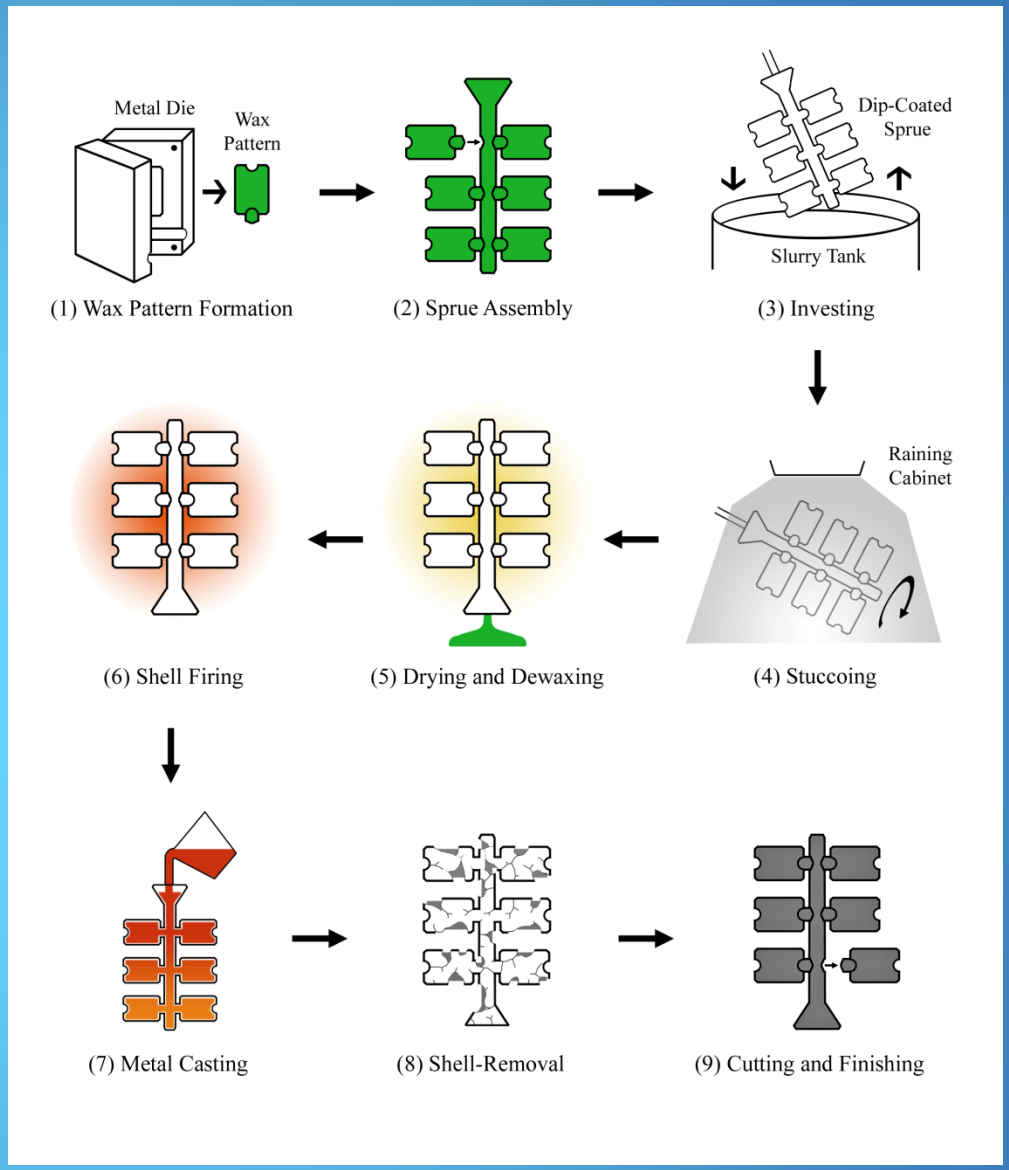
- electrically conductive
- formable into complex shapes
- melted out after shell formation

Carbon particle-filled wax used

1) EPD primary coat

- possess sufficient strength and uniformity
- permeability

Control of voltage, cycle time, particle surface charge



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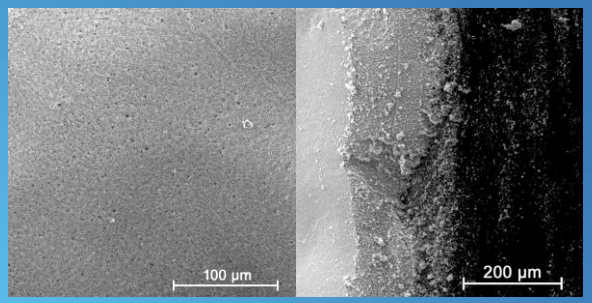
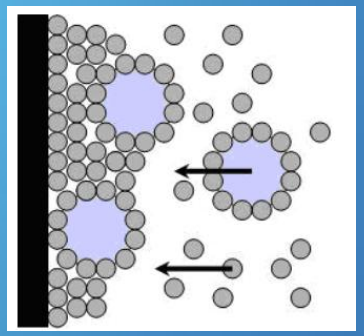
Synopsis & Future Possibilities



- **Electrophoretic Deposition**
  - Can coat complex geometries
  - Microstructurally uniform

- **Graphite Particle filled-wax**
  - Produced homogenously conducting substrate
  - Uniform EPD zircon coatings
    - Modifications made to coat complex substrates
  - High Green Density – low permeability



- **Future Work**
  - Porous coating formed using Pickering emulsions
  - Pulsed d.c. source - control of void size in coating

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