Plasma Electrolytic Polishing

Technology Progress Development for Nb and Cu Substrate Preparation

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PEP Highlights

What are the key benefits PEP?

"Green" water-based salt solutions! No HF acid!
Nb - NH_4F & NaF, Cu – SUBU5 or $(NH_4)_2HPO_4$ or $K_2P_2O_7$

5-30 times faster than regular EP
Up to 30 µm/min, significant reduction polishing time from days to tens of minutes

Lowest roughness 5-50 nm achievable
Efficient polishing! Equal thickness removal yield lowest roughness among competitors (EP, BCP, SUBU)

No preparation of surface is required
PEP can substitute mechanical polishing steps (CBP, grinding, tumbling)

What are the limitations?

High voltage & high current input

Rounding of the edges

High *volume solution / surface area* ratio

Cathode/Anode surface area ratio ≥ 1 – 10

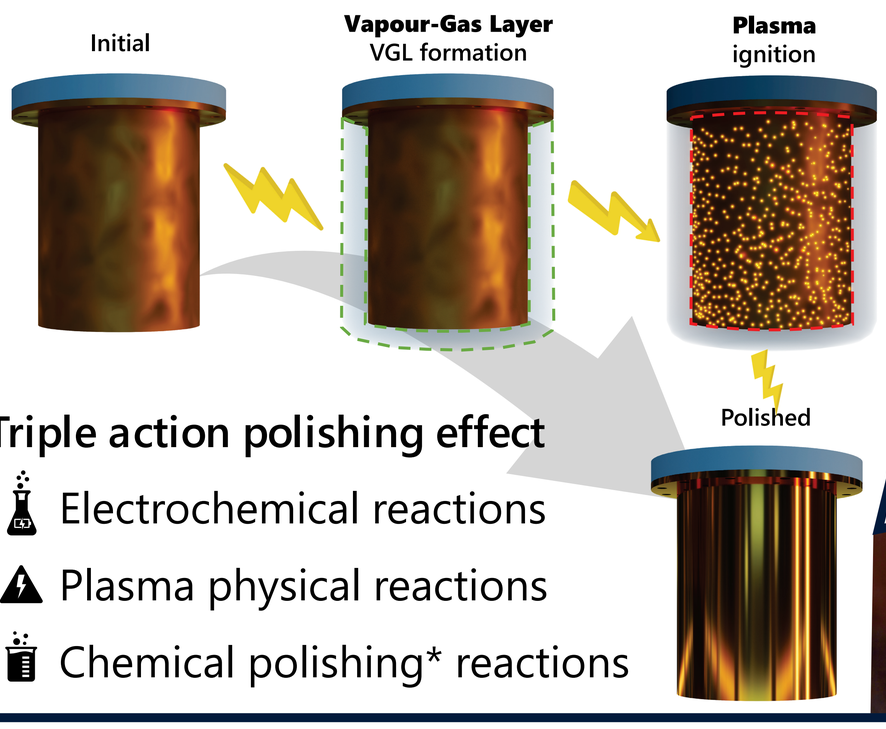
Complex geometries: caves, holes

LNL Patents: 1x Nb 3x Cu

PEP scalability LNL plan

Patented Nb and Cu 4 origin compositions

PEP Mechanism



Triple action polishing effect

Electrochemical reactions

Plasma physical reactions

Chemical polishing* reactions

6 GHz cavity PEP internal polishing

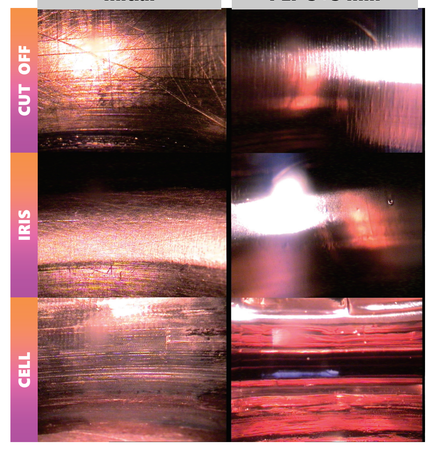
No internal cathode was used!

70 µm

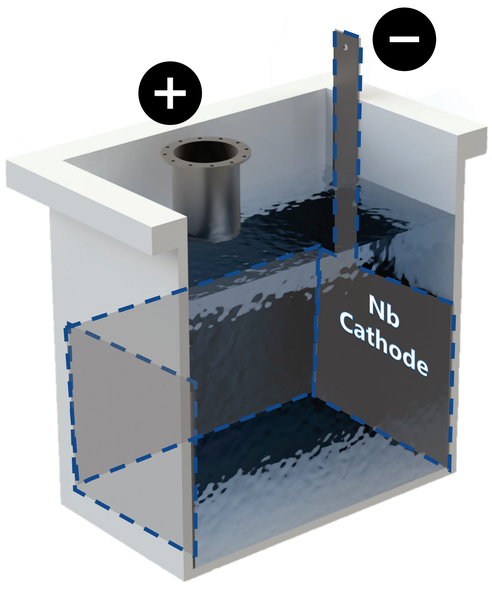
30 A

SUBU5 solution

Sulfamic acid 5-20 g/L
Ammonium citrate 1 g/L
n-Butanol 50 mL/L
Hydrogen Peroxide 50 mL/L



LNL Polishing setup



External cathode

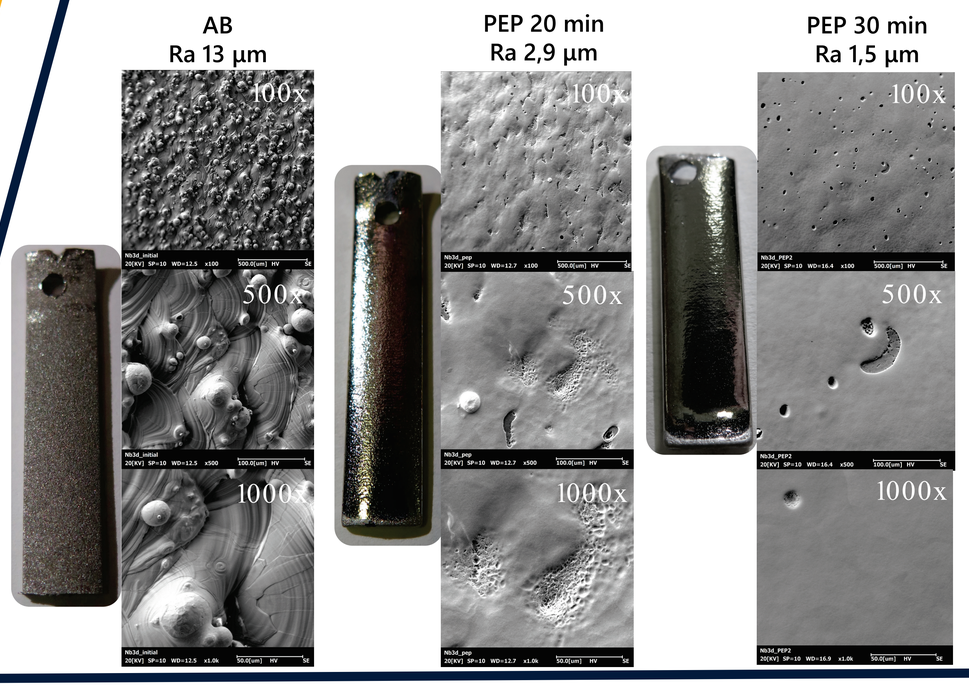
40 L solution

0,1-0,8 A/cm²

70 – 90 C°

300 V

Nb Additive Manufacturing



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