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Protocol

Fabrication nanoporous alumina templates

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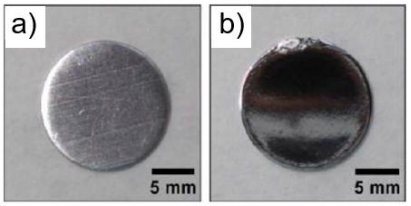
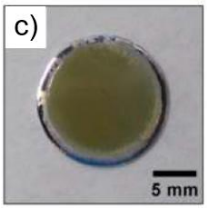
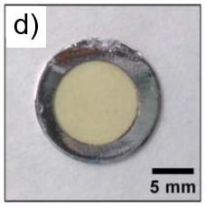
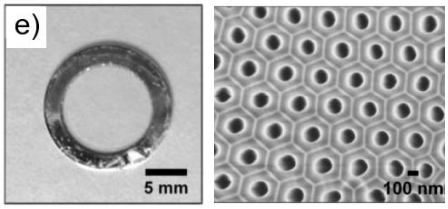
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Fabrication of nanoporous alumina templates

Starting from a commercial Al disc, we obtain a nanoporous alumina template by anodization

1. Electropolishing of commercial Al discs (0.5 mm in thickness) with a 99.999 % in purity • Clean in acetone and then ethanol • Setup: double-jacked 2-electrode electrolytic cell with a Pt mesh as counter electrode • Electrolyte: 1:3 mixture of $HClO_4$ and ethanol • Voltage: 20 V • Temperature: 4 ºC • Time: 5 min	
2. Anodization (for aprox 130 nm-diameter pores): • Setup: Teflon or PEEK electrolytic cell open at the bottom to place the sample (WE) and close tight with an O-ring, including Peltier elements and a feedback control of temperature with thermometers below the sample and within the electrolyte • Electrolyte: aqueous solution of $(COOH)_2$, 0.3 M, and ethanol, 0.9 M. • Temperature range: [0,1] ºC (very important) • Anodization potential: 140 V (rise ramp: 2 V/min) • Anodization time: aprox 150 min for a 100 microns layer	
3. Removal of non-anodized Al • Setup: PEEK cell with O-ring • Removal agent: aqueous solution of $CuCl_2 \cdot 2H_2O$ (0.1 M) and HCl (8.2 M) • Room temperature • Exposure time: 20 min	
3. Removal of the oxide barrier layer (OBL) / pore widening - Removal agent: aqueous solution of H_3PO_4, 0.9 M - First step: • Setup: PEEK cell with O-ring • Temperature: 30-32 ºC • Exposure time: 100 min periodically stirring - Second step: • Setup: watch glass (convex side) over a hot plate • Temperature: 40-45 ºC • Exposure time: 5 min after adding a few droplets of removal agent • Rinse and check the pores at SEM - Repeat second step until the pores are fully open	

Materials:

- Commercial Al discs (0.5 mm in thickness) with a 99.999 % in purity, and smooth surface
- Pt-mesh counter electrode
- Electrolytic Teflon/PEEK cells
- Chemicals: acetone, ethanol, $HClO_4$, $(COOH)_2$, $CuCl_2$, HCl, H_3PO_4.
- Watch glass

Techniques:

- Electropolishing
- High voltage anodization