

## Cyanide-free Electrolyte for Au(III) and Au(I) Electrodepositing Using DMH as Complexing Agent

Gong Luo, Guohui Yuan\* and Ning Li\*\*

Department of Applied Chemistry, Harbin Institute of Technology, Harbin 150001, China

\* E-mail address: ygh@hit.edu.cn, lininghit@263.net

### Experimental

The electrodepositing current densities using in Au(III) and Au(I) electrolytes are 8mA/cm<sup>2</sup>, 2mA/cm<sup>2</sup>, respectively. And a titanium electrode covered by iridium oxide (working area was 2×2 cm<sup>2</sup>) was used as electrodepositing anode. Scanning electron microscopy (SEM) and a scanner were used to analysis micromorphology and macromorphology of the gold layers, respectively. The element contents of gold layer were determined by Energy Dispersive Spectrometer (EDS). X-ray fluorescence (OXFORD CMI900) was used to measure the thickness of the gold layer. And HV-1000 Vickers microhardness tester of Shanghai Shangcai Testermachine Co.,Ltd. was used to measure the microhardness of the Cu sheet electrodeposited gold film. All electrochemical measurements were using a three-electrode electrochemical cell on a CHI760D electrochemical workstation. A saturated calomel electrode (SCE) and titanium electrode covered by iridium oxide (the electrode work area was 2×2 cm<sup>2</sup>) were used as reference and counter electrodes, respectively. A copper electrode with work size of 2×2 cm<sup>2</sup> is used as work cathode, where gold films are deposited. Polarization curves from -0.2 V to -1.5 V, were carried out with a sweep rate of 100 mV/ s. All electrochemical measurements performed at room temperature, and all potentials presented in the article are versus SCE.

**Table SI.** Composition of Au(III) electrodepositing bath.

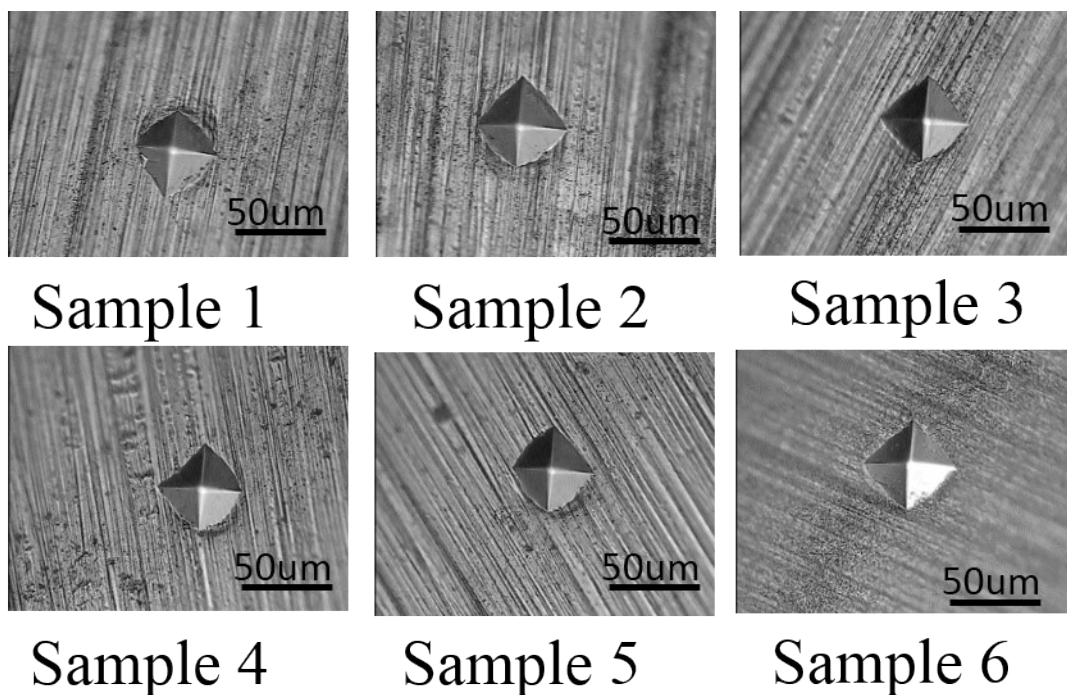
Constituent	g /L
NaAuCl <sub>4</sub>	5
DMH	13
C6H8O7	40
KOH	Variable
pH	Variable
Room temperature	

**Table SII.** Composition of Au(I) electrodepositing bath.

Constituent	g /L
Na <sub>3</sub> Au(SO <sub>3</sub> ) <sub>2</sub>	5
DMH	13
C6H8O7	40
KOH	Variable
pH	Variable
Room temperature	

**Table S III** Microhardness of electrodepositing layers obtained from each electrolyte

sample	1	2	3	4	5	6
Hardness (HV)	123.7	129.7	145.8	165.6	157.3	136.1



**Fig. S1** Rockwell indentation images of each sample; testing force were 200g, holding time were 15s.



**Fig. S2** Photographs of gold electrolytes and gold salt solution placed 2 weeks; all electrolytes had good stability except Au(I) salt solution.