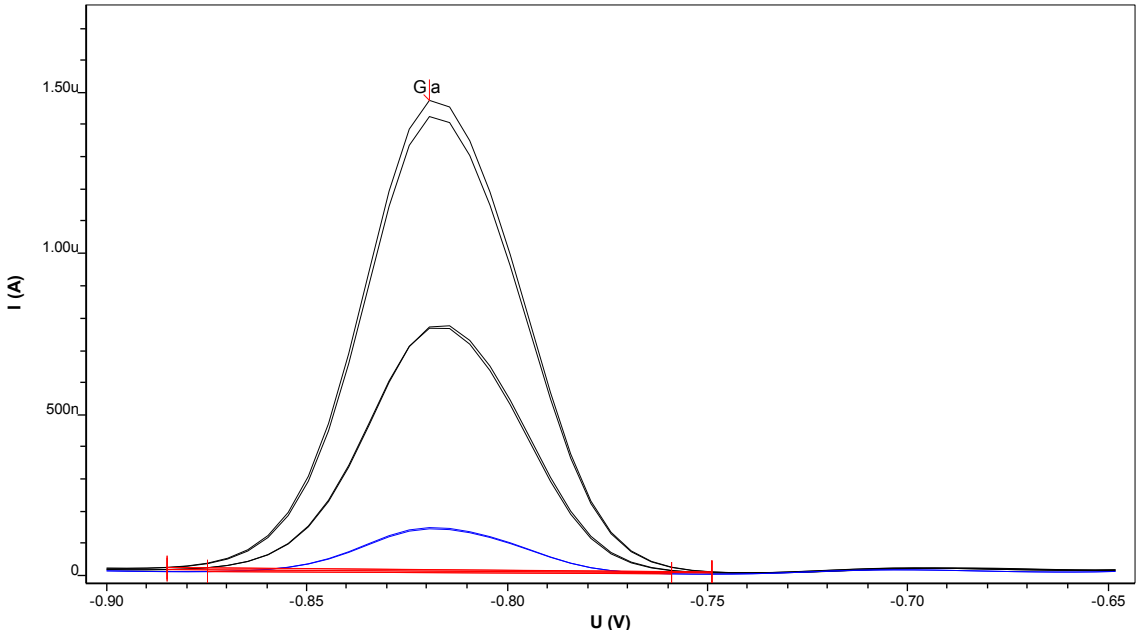
VA Application Note V-205

Determination of gallium in electrolyte solutions for production of copper indium gallium selenide (CIGS) solar cells



Gallium can be determined in electrolyte solutions used in production of copper indium gallium selenide solar cells – also called CIGS cells – for the electrodeposition of the CIGS absorber layer.

The determination of gallium is carried out by anodic stripping voltammetry after dilution of the sample in supporting electrolyte.

Results

Ga in CIGS electrolyte solution
21.7 mg/L

Metrohm

Method description

Sample

Electrolyte solution containing sulfuric acid

Sample preparation

No sample preparation necessary.

Electrodes

Multi-Mode Electrode pro Silanized glass capillaries	6.1246.120 6.1226.050
Ag/AgCl/ KCl (3 mol/L) reference electrode. Bridge electrolyte c(KCl) = 3 mol/L.	6.0728.020 6.1245.010
Platinum rod electrode	6.0343.000

Reagents

$NaClO_4$	Sodium perchlorate, for analysis
$HClO_4$	Perchloric acid, w($HClO_4$) = 70% for trace analysis*
NH_4SCN	Ammonium thiocyanate, for analysis
Ga standard stock solution	ß(Ga^{3+}) = 1 g/L, commercially available
Ultrapure water	Resistivity >18 MΩ·cm (25 °C), type I grade (ASTM D1193)

*e.g., Merck suprapur®, Sigma-Aldrich TraceSelect® or equivalent.

Solutions

Supporting electrolyte	c($NaClO_4$) = 3 mol/L c(NH_4SCN) = 0.5 mol/L pH = 2, adjusted with $HClO_4$
Ga standard solution	ß(Ga^{3+}) = 1 g/L

Analysis

Measuring solution	10 mL supporting electrolyte + 100 µL undiluted sample

Parameters

Working electrode	HMDE
Stirring speed	2000 min^{-1}
Mode	DP
Purge time	300 s
Deposition potential	-0.9 V
Deposition time	30 s
Equilibration time	5 s
Start potential	-0.9 V
End potential	-0.65 V
Pulse amplitude	0.05 V
Potential step	0.005 V
Potential step time	0.4 s
Sweep rate	0.013 V/s
Peak potential Ga	-0.82 V