

SEMI P17-92 (Reapproved 0299) DETERMINATION OF IRON, ZINC, CALCIUM, MAGNESIUM, COPPER, BORON, ALUMINUM, CHROMIUM, MANGANESE, AND NICKEL IN POSITIVE PHOTORESIST METAL ION FREE (MIF) DEVELOPERS BY INDUCTIVELY COUPLED PLASMA EMISSION SPECTROSCOPY (ICP)

This standard was technically reapproved by the Resist Committee and is the direct responsibility of the North American Microlithography Committee. Current edition approved by the North American Regional Standards Committee in October 1998. Initially available at www.semi.org February 1999; to be published February 1999. Originally published in 1992; previously published in 1996.

NOTICE: This Standard or Safety Guideline has an Inactive Status because the conditions to maintain Current Status have not been met. Inactive Standards or Safety Guidelines are available from SEMI and continue to be valid for use.

1 Scope

1.1 This procedure is an ICP plasma emission analysis for determination of iron, zinc, calcium, magnesium, copper, boron, aluminum, chromium, manganese, and nickel in photoresist MIF developers. The applicable concentration range and detection limit will depend upon the element and instrument.

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2 Spectrometer

2.1 An instrument with resolution sufficient to separate the analytical emission lines in Table 1 is required.

Table 1 Analytical Lines of the Elements

<i>Elements Analytical Line</i>	<i>nm</i>
Aluminum	396.152
Calcium	317.933
Copper	324.754
Iron	239.562
Boron	208.960
Magnesium	285.213
Nickel	231.604
Zinc	213.856
Chromium	283.563
Manganese	257.610

3 Standards

3.1 The standards should be weight/weight (mg/kg) and should be diluted weight/weight since results will be expressed in mg/kg.

3.2 The standards are prepared by diluting a concentrated standard. For example, a 500 ppm standard is diluted to 50 ppm with deionized water. This solution is then diluted to 0.25 ppm.

4 Plasma Conditions

4.1 The sample is pumped in the region of 0.7 mL/min. usually with a peristaltic pump attached to the nebulizer. The argon plasma flow rate and RF power should be optimized for the sample using settings recommended in the manufacturer manual. Generally, a plasma gas flow rate of 12 L/min and an RF power of 1.25 kW is required.

5 Quantitation

5.1 No sample preparation nor dilution is required.

5.2 The detector gain is set by measuring the 0.25 ppm standard. The standard should be run intermittently to satisfy reasonable precision. Standard and sample readings should be repeatable within 0.03 ppm. The effect of sample viscosity on delivery of diluted sample to the plasma was not found to be a factor for this procedure. This effect can be checked by adding an internal standard of an element known not to be present in the sample (such as Yttrium) at 1 ppm and checking the emission response vs. an external 1 ppm Yttrium standard.

6 Calculation

$$\text{ppm element (mg/kg)} = \frac{I_x}{I_s} \times 0.25 \text{ ppm}$$

where:

I_x = emission intensity of sample.

I_s = emission intensity of 0.25 ppm standard.

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