

EDS

Engineering,
GM DAEWOO Auto & Technology.
Standards

HEAVY METAL ANALYSIS OF AUTOMOTIVE MATERIALS

EDS-T-7832

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1. PURPOSE

The purpose of this standard is to define analysis of toxic heavy metals contained in automotive parts and materials using Inductively Coupled Plasma (ICP) Spectrometer, which is a device for quantitative and qualitative analysis of inorganic elements.

2. SCOPE

This standard is limited to component analysis of some 70 inorganic elements that are contained in all materials that constitute automotive parts including metal, plastic, rubber, glass, ceramic and cloths, which can be analyzed with ICP spectrometer. This standard is used for analysis of Pb, Hg and Cd that are subject to control under EU vehicle scrap process standard (ELV: 2000/53/EC). Here, analysis of hexavalent chromium shall be done by another method such as light absorption method.

3. ICP PRINCIPLE & ARCHITECTURE

3.1. Principle

When sufficient energy is given to neutral atom, atoms transition from ground state to an excited state. In particular, atoms and ions of argon plasma, which is in excited state due to high resistance thermal energy (about 8000°C), emits in the form of light energy the drop in energy level when they transition to a lower energy state. This is called 'emission.' The intensity of the radiant light from emission wave of each element can be measured and compared with standard material and be quantified. This intensity can be compared against element wavelength library for quantitative analysis. This is because argon plasma is very stable so that it lends well to analysis of any matrix solution, entails no interferences, and allows analysis of extremely small amount (ppb) of inorganic elements to facilitate analysis of many elements within a given time.

The main usage of ICP spectrometer is analysis of toxic heavy metals and components contained in all materials that are soluble in acid, including iron, non-iron metals, plastics, paints, oil products, drinking water, waste water and food products. It is an analysis device that provides ppb level result through a single analysis of elements contained in a test sample.

3.2. Organization

3.2.1. Light source

RF Generator

3.2.2. Sample introducing system

- 1) Peristaltic pump
- 2) Nebulizer
- 3) Nebulizer chamber
- 4) Plasma Torch

3.2.3. Spectrometer

- 1) Grating
- 2) Detector

3.2.4. Data system (Device operation and data processor)

4. EQUIPMENT

4.1. ICP (Inductively Coupled Plasma)

4.2. Microwave digestion (Pre-process Equipment)

4.3. Pre-process devices

4.3.1. Hot plate

4.3.2. 250 ml, 400 ml Beaker

4.3.3. 50 ml, 100 ml, 500 ml Volumetric flask

4.3.4. Diameter 7~8cm of watch glass

4.3.5. Filter paper No. 2(Diameter 90 mm, 5A)

4.3.6. Pipette

4.3.7. 0.0001g unit balance for analysis

4.4. Reagents

4.4.1. HNO_3 , GR/AR grade

4.4.2. HCl , GR/AR grade

4.4.3. 30% H_2O_2

4.4.4. 48% HF , GR/AR grade

4.4.5. 5% H_3BO_3

4.4.6. Standard solution 1000 mg/ l for analysis such as Pb, Hg, Cd and Cr.

5. PRE-PROCESS

Since polymer test sample consists of organic materials, it requires a certain pre-processing prior to analysis. Multiple pre-process methods are available. A suitable method shall be selected for element and test sample of analysis. Metals dissolve easily in acid in general.

5.1. Pre-processing of polymer test sample for analysis of Pb, Cd and Cr

In general, polymer test samples that do not contain silicon component are easily wet decomposed by nitric acid.