

## SEA NO. 13 JUL.1998 Introduction to Spectrum Matching

### 1. Overview

Spectrum matching is search software that compares spectrum registered in a "library" of sample spectrum of pre-determined known identities with spectrum of unknown samples, and selects the known spectrum nearest the unknown spectrum. Spectrum matching is convenient for:

- Differentiating various material alloys  
SUS303 and 304 can be determined in about 10 seconds without analysis. Determining steel alloys can be done without comparing quantitative values and standardized values.
- Differentiating good articles and defective articles  
Registering the spectrum of a good article as a "library" allows you to determine if a product is defective.

The spectrum changes when contaminants are mixed in and the degree of difference increases. The results of determining the degree of difference can be freely set, and when the degree of difference is outside the standard then the result will be displayed as DIFFER. The default setting of ID results for the "degree of difference" are displayed as SAME for 20 or less, SIMILAR for 200 or less, and DIFFER for over 200.

A maximum of 200 spectrum files can be registered at one time in a library.

### 2. Example of Matching

#### 2.1 Base Alloy (Inconel)

The Ni base alloy standard sample is registered as the library. Matching is performed at a measurement time of 10 seconds using Inconel-825. Matching results show correct identification by displaying SAME in the INCONEL. 825 row and DIFFER in other row alloys.

Spectrum Name	Differ	Result
INCONEL. 825	5.3	SAME
INCONEL. 800	722.4	DIFFER
INCONEL. 690	1172.6	DIFFER
INCONEL. 625	3022.6	DIFFER

## 2.2 Potassium Carbonate

We matched two samples with the library potassium carbonate. One sample is the same potassium carbonate sample as the one used for the library and the other sample is a mixture of potassium carbonate and calcium chloride ( $\text{CaCO}_3 : \text{CaCl}_2 = 4:1$ ).

(a)			(b)		
Spectrum Name	Differ	Result	Spectrum Name	Differ	Result
CaCO3.STD	5.2	SAME	CaCO3.STD	149.2	SIMILAR

(a) shows the result of the matching of the potassium carbonate sample. The degree of difference (Differ) is small and the Result column displays SAME.

(b) shows the result of the matching of the potassium carbonate sample mixed with calcium chloride. The degree of difference (Differ) is comparatively larger at 149.2 and the Result column displays SIMILAR. (You can set this so that DIFFER is displayed here instead of SIMILAR.) The degree of difference increases as contaminants are mixed in and SAME is not displayed in the "Result" column. You can also check whether the entire "degree of difference" increases due to an increase in the "degree of difference" of any one element by displaying the conditions.

Item	Conditions
Spectrum	CaCO3.STD
Comments	
Measurement Time	100.1 sec
Effective Time	70.9 sec
Beam diameter	3 mm
Voltage	50 kV
Current	60 $\mu\text{A}$
Mylar container	No
Degree of difference	149.384523 Similar
	Cl: 115.0, Ca: 21.9, K: 1.4

The table above shows conditions of matching a sample of a calcium chloride compound. The "Degree of difference" here shows that chlorine (Cl) occupies about 80% of the degree of difference and has the largest degree of difference.

## 3. Summary

The Spectrum Matching functions allows you to examine what a sample is by comparison with a library with out performing quantitative analysis. It is also convenient as an identification routine for determining whether a product is good or defective.