

electron microscopy, electron probe x-ray microanalysis, and Auger electron spectroscopy, by which inclusion chemistries can be determined.

Again, it should be emphasized that this Handbook is meant as a tool to familiarize the nonanalytical specialist with modern analytical techniques and to help him identify techniques that might be applied to his problems. The Handbook is not meant to be an analytical textbook or to replace indispensable consultation with materials and analytical specialists.

How To Use the Handbook

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Tables and Flow Charts

The tables and flow charts in this section have been developed as tools to provide information about the most widely used methods of analysis for different classes of materials. These tables and charts are *not* intended to be all-inclusive but to identify the most commonly used techniques for the types of materials to be characterized and the types of information needed. As a result, many techniques that require special modifications or conditions to perform the desired analysis are omitted. The previous section of this article describes how to use these tools. After examining the tables or charts, the reader is encouraged to refer to the appropriate articles in the Handbook for additional information prior to consultation with an analytical specialist.

Abbreviations used in the headings of the tables are defined in Table 9.

Table 9 Abbreviations used in Tables 1 through 8

Elem	Elemental analysis
Alloy ver	Alloy verification
Iso/Mass	Isotopic or mass analysis
Qual	Qualitative analysis (identification of constituents)
Semiquant	Semiquantitative analysis (order of magnitude)
Quant	Quantitative analysis (precision of $\pm 20\%$ relative standard deviation)
Macro/Bulk	Macroanalysis or bulk analysis
Micro	Microanalysis ($\lesssim 10 \mu\text{m}$)
Surface	Surface analysis
Major	Major component ($>10 \text{ wt}\%$)
Minor	Minor component (0.1 to 10 wt%)

Trace	Trace component (1 to 1000 ppm or 0.0001 to 0.1 wt%)
Ultratrace	Ultratrace component (<1 ppm or <0.0001 wt%)

The acronyms listed in Table 10 are used in the tables and charts (for additional acronyms and abbreviations, see the section "Abbreviations and Symbols" in this Volume).

Table 10 Acronyms for materials characterization methods used in Tables 1 through 8

AAS	Atomic absorption spectrometry
AES	Auger electron spectroscopy
COMB	High-temperature combustion
EFG	Elemental and functional group analysis
EPMA	Electron probe x-ray microanalysis
ESR	Electron spin resonance
FT-IR	Fourier transform infrared spectroscopy
GC/MS	Gas chromatography/mass spectrometry
GMS	Gas mass spectrometry
IA	Image analysis
IC	Ion chromatography
ICP-AES	Inductively coupled plasma atomic emission spectroscopy
IGF	Inert gas fusion
IR	Infrared spectroscopy
ISE	Ion selective electrode
LC	Liquid chromatography

LEISS	Low-energy ion-scattering spectroscopy
MFS	Molecular fluorescence spectroscopy
NAA	Neutron activation analysis
NMR	Nuclear magnetic resonance
OES	Optical emission spectroscopy
OM	Optical metallography
RBS	Rutherford backscattering spectrometry
RS	Raman spectroscopy
SAXS	Small-angle x-ray scattering
SEM	Scanning electron microscopy
SIMS	Secondary ion mass spectroscopy
SSMS	Spark source mass spectrometry
TEM	Transmission electron microscopy
UV/VIS	Ultraviolet/visible absorption spectroscopy
XPS	X-ray photoelectron spectroscopy
XRD	X-ray diffraction
XRS	X-ray spectrometry

Sampling

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Introduction