ISO/TR 14187:2011-08 (E)

Surface chemical analysis - Characterization of nanostructured materials

Contents

Page

Foreword iv

Introduction v

1 Scope 1

2 Terms and definitions 1

3 Symbols and abbreviated terms 1

4 Characterization of nanostructured materials with surface analysis methods 3
4.1 Introduction 3
4.2 Electron Spectroscopies (AES and XPS) 6
4.2.1 Surface functionalization and product formation 7
4.2.2 Presence of contamination and coatings 8
4.2.3 Orientation of surface molecules 8
4.2.4 Coating or layer thickness 8
4.2.5 Near-surface elemental distribution 10
4.2.6 Particle size 10
4.2.7 Particle location, composition and shape 11
4.2.8 Other properties: electronic characteristics and surface acidity 11
4.3 Ion-beam surface analysis methods (SIMS and LEIS) 12
4.3.1 SIMS and examples of SIMS applications 12
4.3.2 Low energy ion scattering and applications to nanomaterials 13
4.4 Scanning probe microscopy 14
4.5 Surface characterization of carbon nanostructures 15

5 Analysis considerations, issues and challenges associated with characterization of nanostructured materials: Information for the analyst 15
5.1 Introduction 15
5.2 General considerations and analysis challenges 16
5.3 Physical properties 17
5.4 Particle stability and damage: influence of size, surface energy and confluence of energy scales 18
5.4.1 Crystal structure 18
5.4.2 Damage and probe effects 19
5.4.3 Time and environment 19
5.5 Sample mounting and preparation considerations 24
5.6 Specific considerations for analysis of nanostructured materials using XPS, AES, SIMS and SPM 24
5.6.1 Introduction 24
5.6.2 Issues related to application of XPS to nanomaterials 24
5.6.3 Issues related to the application of AES to nanostructured materials 27
5.6.4 Issues related to application of SIMS to nanoparticles 27
5.6.5 Issues related to the application of scanning probe methods to nanoparticles 29

6 General characterization needs and opportunities for nanostructured materials 29

Bibliography 31