

## CONTENTS

<b>1. Introduction</b>	
1.1 How, Where, and Why Dust Ignitions Occur	1
1.2 Ignition Sources – Statistical Data	2
1.3 Ignition Sources	8
1.4 Ignition Properties of Powdered Materials	10
1.5 Dust-Classification Systems	11
1.6 Protection Systems	13
1.7 General Considerations	14
<b>2. Ignition Sources</b>	
2.1 Welding, Cutting, and Flames	15
2.2 Self-Heating – Spontaneous Combustion	17
2.3 Hot Surfaces	22
2.4 Sparks	26
2.5 Secondary Ignition	42
<b>3. Static Electricity</b>	
3.1 Introduction	43
3.2 Definitions and Relationships	44
3.3 Measurement Techniques	55
3.4 Examples of Electrostatic Measurements in an Industrial Environment	80
<b>4. Electrostatic Ignition of Powders</b>	
4.1 Electrostatic Charging of Powders	85
4.2 Electrostatic Charge Accumulation	90
4.3 Electrostatic Safety Criteria	93
4.4 Elimination of Static	98
4.5 Electric Shock	108
4.6 Safety in Electrostatic Powder-Coating Systems	113
<b>5. Powder Properties and Their Measurement</b>	
5.1 Introduction	115
5.2 General Properties—Particle Size and Shape	116
5.3 Dust Resistivity	118
5.4 Moisture Content	122
5.5 Dust Concentration in the Workplace	122

5.6	Ignitability	124
5.7	Thermal Tests	128
5.8	Minimum Ignition Energy	142
5.9	Minimum Explosive Concentration	148
5.10	Maximum Oxygen Concentration	149
5.11	Maximum Rate of Pressure Rise; Maximum Explosive Pressure	150
5.12	Effect of Particle Properties on Ignition Properties	155
5.13	Effect of Hot Environments on Ignition Parameters	162
5.14	Summary	163
<b>6.</b>	<b>Design of a Processing Plant for Safety</b>	
6.1	Formal Safety Analysis	165
6.2	Hazards Associated with Industry Processes	174
6.3	The Human Element	189
6.4	Dust Control	190
<b>7.</b>	<b>Dust Explosion Protection</b>	
7.1	Introduction	195
7.2	Containment of Explosions	196
7.3	Explosion Venting – Pressure Relief for Explosion Protection	197
7.4	Explosion Suppression	212
7.5	Inerting	219
7.6	Flame Traps and Automatic Barriers	221