

# **IAL MARKET REPORT**

## **AN OVERVIEW OF THE EUROPEAN RADIATION CURING MARKET**

**© IAL CONSULTANTS  
MARCH 2001**

109 Uxbridge Road, Ealing, London W5 5TL  
Tel: +44 (0) 20 8810 0919 Fax: +44 (0) 20 8566 4931  
Email: [ial@brg.co.uk](mailto:ial@brg.co.uk)  
Web site: [www.ialconsultants.com](http://www.ialconsultants.com)

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted in any form, or by any means, electronic, mechanical, photocopying, recording or otherwise without the prior permission of the copyright owner.

---

## NOTE

The information given in this report has been compiled from published sources and interpreted from fieldwork based on informed opinions. Whilst every care has been taken in the preparation of the report, there may have been some errors in the information obtained. Although it is impossible to verify every single detail by cross checking, we believe the general picture provided is reasonably accurate and comprehensive.

Many IAL reports contain an overview of selected company financial information and capabilities based on published sources where available. Although the companies represented are believed to be the major suppliers the profiles are meant to be indicative rather than definitive.

It is fundamental to the philosophy of IAL Consultants to constantly seek to extend and improve our service to clients. In pursuit of these aims, we shall be pleased to consider all requests for regular or periodic updating of all or any part of the information contained in this report, or for extensions in coverage in terms of product areas, market sectors and/or geographic regions.

We are, of course, always happy to discuss with any subscriber the possibility of undertaking further work, whether arising out of this report or in different business areas.

## MORE INFORMATION ON IAL CONSULTANTS

At the end of this report you will find a copy of our corporate brochure and a list of our latest published reports. Should you require more information on either our published reports or our private client services, please contact us at the address given.

Full details on all IAL Consultants published studies (including full tables of contents and tables of tables) and ad-hoc research services can be found on our website :

**[www.ialconsultants.com](http://www.ialconsultants.com)**

---

# CONTENTS

<b>1. INTRODUCTION.....</b>	<b>1</b>
1.1 METHODOLOGY & SCOPE .....	1
1.2 FORECASTS.....	1
1.3 UNITS OF VOLUME.....	1
<b>2. EXECUTIVE SUMMARY.....</b>	<b>3</b>
<b>3. RADIATION CURING TECHNOLOGY .....</b>	<b>5</b>
3.1 TECHNOLOGY SUMMARY .....	5
3.2 ULTRA VIOLET CURING.....	6
3.2.1 <i>Mechanism</i> .....	6
Free Radical.....	6
Cationic Curing .....	7
3.2.2 <i>Photoinitiation and Composition</i> .....	7
Cationic Systems .....	8
Charge Transfer Complexes .....	8
3.2.3 <i>Ultra Violet Light Sources</i> .....	9
3.3 ELECTRON BEAM CURING .....	9
3.4 HYBRID CURE SYSTEMS.....	10
3.5 DUAL CURE SYSTEMS.....	10
3.6 WATER-BASED SYSTEMS.....	11
<b>4. THE MARKET FOR RADIATION CURING RAW MATERIALS.....</b>	<b>13</b>
4.1 INTRODUCTION AND SUMMARY .....	13
4.2 MONOMERS.....	15
4.3 OLIGOMERS .....	17
4.4 PHOTINIATORS .....	19
4.4.1 <i>Benzyl Dimethyl Ketone</i> .....	19
4.4.2 <i>Benzophenone</i> .....	20
4.4.3 <i>Thioxanthenes</i> .....	20
4.4.4 <i>Phosphine Oxides</i> .....	20
4.4.5 <i>Amine Synergists and Other Systems</i> .....	21
4.4.6 <i>Market for Photoinitiators</i> .....	21
4.5 CATIONIC SYSTEMS.....	22
4.6 ELECTRON BEAM (EB) SYSTEMS.....	23
<b>5. THE MARKET FOR RADIATION CURING PRODUCTS.....</b>	<b>25</b>
5.1 PRINTING INKS.....	25
5.1.1 <i>Technical Overview</i> .....	25
5.1.2 <i>The Total Market for UV Inks</i> .....	28
5.1.3 <i>UV Offset Inks</i> .....	30
5.1.4 <i>UV Screen Inks</i> .....	32
Display Applications .....	32
Electronic Applications .....	34
5.1.5 <i>UV Flexo Inks</i> .....	36
5.1.6 <i>Overprint Lacquers</i> .....	37
5.2 INDUSTRIAL COATINGS.....	39
5.2.1 <i>Industrial Wood Finishes</i> .....	40
Prospects in Joinery .....	41
Prospects in Parquet .....	42
5.2.2 <i>Plastic Coatings</i> .....	44
Mobile Phones .....	44
5.2.3 <i>Opto-Electronic Coatings</i> .....	45
Semiconductor Photoresists.....	47

Printed Circuit Board (PCB) Resists .....	49
Optical Fibres .....	50
Liquid Crystal Displays .....	51
5.2.4 <i>UV Curing Release Coatings</i> .....	51
5.2.5 <i>Electron Beam Coatings</i> .....	53
5.3 ADHESIVES .....	54
5.3.1 <i>UV Curing Structural Adhesives</i> .....	55
Electronics and Electrical .....	56
Medical .....	57
Automotive and Components .....	57
Glass and Jewellery .....	58
Opto-electronics .....	58
European Market for UV Curing Structural Adhesives .....	60
Pricing .....	63
Supply Structure .....	63
Future Opportunities for UV Structural Adhesives .....	67
5.3.2 <i>UV Curing Non-Structural Adhesives</i> .....	67
UV Cured Pressure Sensitive Adhesives .....	67
UV Cured Laminating Adhesives .....	71
5.4 OTHER APPLICATIONS .....	73
5.4.1 <i>Stereolithography</i> .....	73
5.4.2 <i>Laser Photolithography</i> .....	74
5.5 NEW MARKET OPPORTUNITIES AND THREATS .....	77
5.5.1 <i>Opportunities</i> .....	77
Rapid Manufacturing (RM) .....	77
Superior Resin Performance .....	77
New Rapid Prototyping Technologies .....	77
5.5.2 <i>Threats</i> .....	78
<b>6. THE MARKET FOR RADIATION CURING EQUIPMENT .....</b>	<b>79</b>
6.1 ULTRA VIOLET CURING EQUIPMENT .....	79
6.2 ELECTRON BEAM CURING EQUIPMENT .....	80
6.3 STEREOLITHOGRAPHIC EQUIPMENT .....	81
<b>7. MARKETING FACTORS .....</b>	<b>83</b>
7.1 GENERAL CONSIDERATIONS .....	83
7.2 PRICES .....	83
7.3 LEGISLATION .....	84
7.3.1 <i>The Solvent Emissions Directive</i> .....	84
7.3.2 <i>The IPPC (Integrated Pollution Prevention &amp; Control) Directive and the Packaging Waste Directive</i> ...	86
7.3.3 <i>EU Plastics Directive 90/128</i> .....	87
7.4 OPPORTUNITIES FOR RADIATION CURING .....	87
<b>8. MAJOR SUPPLIERS OF RADIATION CURING MATERIALS .....</b>	<b>89</b>
8.1 SUPPLIERS OF RAW MATERIALS .....	89
8.1.1 <i>Austria</i> .....	89
8.1.2 <i>Belgium</i> .....	89
8.1.3 <i>France</i> .....	90
8.1.4 <i>Germany</i> .....	90
8.1.5 <i>Italy</i> .....	92
8.1.6 <i>Netherlands</i> .....	92
8.1.7 <i>Spain</i> .....	93
8.1.8 <i>Sweden</i> .....	93
8.1.9 <i>Switzerland</i> .....	93
8.1.10 <i>United Kingdom</i> .....	94
8.2 SUPPLIERS OF FORMULATED PRODUCTS .....	98
8.2.1 <i>Austria</i> .....	98
8.2.2 <i>Belgium</i> .....	98
8.2.3 <i>Denmark</i> .....	99
8.2.4 <i>France</i> .....	99
8.2.5 <i>Germany</i> .....	101
8.2.6 <i>Italy</i> .....	104

8.2.7	Netherlands .....	104
8.2.8	Norway .....	105
8.2.9	Portugal .....	105
8.2.10	Spain .....	105
8.2.11	Sweden .....	106
8.2.12	Switzerland .....	107
8.2.13	United Kingdom .....	107
<b>9.</b>	<b>SUPPLIERS OF RADIATION CURING EQUIPMENT .....</b>	<b>115</b>
9.1	ULTRAVIOLET CURING EQUIPMENT .....	115
9.1.1	Germany .....	115
9.1.2	Italy .....	115
9.1.3	Switzerland .....	115
9.1.4	United Kingdom .....	116
9.1.5	USA .....	117
9.2	ELECTRON BEAM CURING EQUIPMENT .....	117
9.2.1	Germany .....	117
9.2.2	Netherlands .....	117
9.2.3	Sweden .....	117
9.3	STEREOLITHOGRAPHIC EQUIPMENT SUPPLIERS .....	117
9.3.1	France .....	117
9.3.2	Germany .....	117
9.3.3	Japan .....	118
9.3.4	United Kingdom .....	118
9.3.5	USA .....	118
<b>10.</b>	<b>SOURCES OF INFORMATION .....</b>	<b>119</b>
10.1	TRADE ASSOCIATIONS – PRINTING INKS & COATINGS .....	119
10.1.1	Austria .....	119
10.1.2	Belgium .....	119
10.1.3	Denmark .....	120
10.1.4	Finland .....	120
10.1.5	France .....	120
10.1.6	Germany .....	120
10.1.7	Greece .....	120
10.1.8	Ireland .....	120
10.1.9	Italy .....	120
10.1.10	Luxembourg .....	121
10.1.11	Netherlands .....	121
10.1.12	Norway .....	121
10.1.13	Portugal .....	121
10.1.14	Spain .....	121
10.1.15	Sweden .....	121
10.1.16	Switzerland .....	121
10.1.17	United Kingdom .....	122
10.2	TRADE ASSOCIATIONS – ADHESIVES .....	122
10.2.1	Austria .....	122
10.2.2	Belgium .....	122
10.2.3	Denmark .....	122
10.2.4	Finland .....	122
10.2.5	France .....	122
10.2.6	Germany .....	123
10.2.7	Italy .....	123
10.2.8	Netherlands .....	123
10.2.9	Norway .....	123
10.2.10	Portugal .....	123
10.2.11	Spain .....	124
10.2.12	Sweden .....	124
10.2.13	Switzerland .....	124
10.2.14	United Kingdom .....	124

10.3 END-USE INDUSTRY ASSOCIATIONS..... 125

## TABLE OF TABLES

<b>1. INTRODUCTION .....</b>	<b>1</b>
1.1 METHODOLOGY & SCOPE .....	1
1.2 FORECASTS.....	1
1.3 UNITS OF VOLUME .....	1
<b>2. EXECUTIVE SUMMARY .....</b>	<b>3</b>
<b>3. RADIATION CURING TECHNOLOGY .....</b>	<b>5</b>
3.1 TECHNOLOGY SUMMARY .....	5
3.2 ULTRA VIOLET CURING .....	6
Mechanism of UV Curing.....	7
Comparison of UV Curing Systems.....	8
3.3 ELECTRON BEAM CURING.....	9
3.4 HYBRID CURE SYSTEMS .....	10
3.5 DUAL CURE SYSTEMS.....	10
3.6 WATER-BASED SYSTEMS .....	11
<b>4. THE MARKET FOR RADIATION CURING RAW MATERIALS.....</b>	<b>13</b>
4.1 INTRODUCTION AND SUMMARY .....	13
European Market for Radiation Curing Chemicals by Cure Chemistry, 2000–2005 (Tonnes) .....	14
European Market for Free Radical UV Curing Compounds by Sector, 2000–2005 (Tonnes) .....	14
European Market for Cationic UV Curing Compounds by Sector, 2000–2005 (Tonnes) .....	14
4.2 MONOMERS .....	15
European Market for Acrylate-based Monomers by Type, 2000–2005 (Tonnes).....	15
Typical Selling Prices for Acrylate-based Monomers in Europe by Type, 2000 (€/kg & DM/kg) .....	16
4.3 OLIGOMERS .....	17
European Radcure Market for Acrylate Oligomers, 2000–2005 (Tonnes).....	17
Typical Selling Prices for Acrylate Oligomers in Europe by Type, 2000 (€/kg & DM/kg) .....	18
4.4 PHOTOINITIATORS.....	19
Typical Photoinitiator Prices in the European Radcure Market by Type, 2000 (€/kg &DM/kg) .....	19
Photoinitiator Demand in the European Radcure Market, 2000–2005 (Tonnes) .....	21
4.5 CATIONIC SYSTEMS .....	22
Chemical Composition of Cationic Curing Systems (%).....	22
European Market for Cationic UV Curing Compounds by Sector, 2000–2005 (Tonnes).....	23
4.6 ELECTRON BEAM (EB) SYSTEMS .....	23
<b>5. THE MARKET FOR RADIATION CURING PRODUCTS .....</b>	<b>25</b>
5.1 PRINTING INKS .....	25
Major Constituents of Radiation Curing Inks .....	25
European Market for UV Inks, 2000 (Tonnes) .....	28
European Market for UV Inks, 2005 (Tonnes) .....	29
European Market for UV Offset Inks, 2000–2005 (Tonnes)*.....	30
European Market for UV Screen Inks, 2000–2005 (Tonnes).....	32
European Market for CDs & DVDs, 2000–2004 (Billion Units).....	34
European Market for UV Flexo Inks, 2000–2005 (Tonnes) .....	36
European Market for UV Curable Overprint Lacquers, 2000–2005 (Tonnes).....	38
5.2 INDUSTRIAL COATINGS .....	39
European Market for UV Curable Industrial Coatings, 2000–2005 (Tonnes).....	40
Market for Parquet Flooring in Europe, 1998 (Million m <sup>2</sup> ) .....	42
European Market for UV Curing Opto-Electronic Coatings by Type, 2000 (Tonnes).....	46
European Market for UV Curing Opto-Electronic Coatings by Type, 2005 (Tonnes).....	47
Leading Suppliers in the Global Photoresist Market, 1999 (% Share).....	48
European Market for UV Curable Silicone Release Coatings, 2000–2005 (Tonnes).....	53
5.3 ADHESIVES .....	54
European Market for UV Adhesives by Type, 2000–2005 (Tonnes).....	54
European Market for UV Cured Structural Adhesives by Application, 2000-2005 (Tonnes & % Growth p.a.).....	60

	European Market for UV Cured Structural Adhesives by Geographical Region, & Application 2000 (Tonnes) .....	61
	European Market for UV Cured Structural Adhesives by Geographical Region & Application, 2005 (Tonnes) .....	62
	Typical Prices for UV Curing Structural Adhesives (€/kg) .....	63
	Leading Suppliers of UV Cured Structural Adhesives to the European market by Sector.....	64
	European Market for UV Cured Pressure Sensitive Adhesives by Product and Country, 2000-2005 (Tonnes) .....	68
	Typical Prices for Main UVPSA Resin Types (€/kg) .....	69
	European market for UVPSAs by Resin Type, 2000 (%) .....	69
	Market Shares of Major Suppliers in UV Pressure-Sensitive Adhesives Market, 2000 (%).....	70
	European Market for PSAs by Adhesive Type (%) .....	71
	European Market for UV Cured Laminating Adhesives by Type, 2000-2005 (Tonnes).....	72
	European Market for UV Cured Laminating (Flexo) Adhesives by Country , 2000–2005 (Tonnes).....	72
5.4	<b>OTHER APPLICATIONS</b> .....	73
	European Market for Photolithographic Polymers, 2000–2005 (Tonnes).....	75
	Equipment Manufacturer - Resin Supplier Alliances in the Photolithographic Market .....	76
5.5	<b>NEW MARKET OPPORTUNITIES AND THREATS</b> .....	77
<b>6.</b>	<b>THE MARKET FOR RADIATION CURING EQUIPMENT</b> .....	<b>79</b>
6.1	<b>ULTRA VIOLET CURING EQUIPMENT</b> .....	79
	Market Shares of Major Suppliers in the European UV Curing Equipment Market (%).....	80
	Pricing of UV Curing Equipment (€/Unit).....	80
6.2	<b>ELECTRON BEAM CURING EQUIPMENT</b> .....	80
	Usage of Electron Beam Technology by Application (%).....	81
6.3	<b>STEREOLITHOGRAPHIC EQUIPMENT</b> .....	81
	World-leading Suppliers of Rapid Processing Equipment .....	82
<b>7.</b>	<b>MARKETING FACTORS</b> .....	<b>83</b>
7.1	<b>GENERAL CONSIDERATIONS</b> .....	83
7.2	<b>PRICES</b> .....	83
7.3	<b>LEGISLATION</b> .....	84
	Requirements of the Solvent Emissions Directive Pertinent to the Radiation Curing Industry.....	85
7.4	<b>OPPORTUNITIES FOR RADIATION CURING</b> .....	87
<b>8.</b>	<b>MAJOR SUPPLIERS OF RADIATION CURING MATERIALS</b> .....	<b>89</b>
8.1	<b>SUPPLIERS OF RAW MATERIALS</b> .....	89
8.2	<b>SUPPLIERS OF FORMULATED PRODUCTS</b> .....	98
<b>9.</b>	<b>SUPPLIERS OF RADIATION CURING EQUIPMENT</b> .....	<b>115</b>
9.1	<b>ULTRAVIOLET CURING EQUIPMENT</b> .....	115
9.2	<b>ELECTRON BEAM CURING EQUIPMENT</b> .....	117
9.3	<b>STEREOLITHOGRAPHIC EQUIPMENT SUPPLIERS</b> .....	117
<b>10.</b>	<b>SOURCES OF INFORMATION</b> .....	<b>119</b>
10.1	<b>TRADE ASSOCIATIONS – PRINTING INKS &amp; COATINGS</b> .....	119
10.2	<b>TRADE ASSOCIATIONS – ADHESIVES</b> .....	122
10.3	<b>END-USE INDUSTRY ASSOCIATIONS</b> .....	125