

RADCURE DEVELOPMENTS IN RUSSIA

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ABSTRACT

The survey dwells on three main parts:

1. Insight into the state of radiation curing technology in Russia.
2. Scope of the scientific potential.
3. Certain regard on forecasts, opportunities and prospects for Russian RadTech market.

INTRODUCTION

Dynamics of radcure technologies' dissemination is docketed in Table 1. In 70's Russian scientific institutes had successfully developed radcure process due to the lavish state subsidizing. The laboratories that these institutes had at their disposal had used state-of-the-art equipment. It had broadened the plants horizons as well. EB coatings on TV set bodies, UV coatings and inks for chipboards and printed circuit boards, materials for photopolymer printing plates were implemented to the industry.

In 1980's, when the Russian economics has been almost collapsed, RadTech sector also plunged into turmoil. The lack of acrylic monomers became the decisive factor of radcure stalling. Nevertheless some radcure processes and systems had been developing even in this recession period (Table 1).

Nowadays, despite the great changes in the country, clouds continue to hang over the Russian RadTech market. However, the second advent of RadTech technology could be envisaged.

Our market data is based mostly on own information retrieval as well as on information collected by RadTech devotees.

Table 1. Dissemination of radcure technologies in Russia

1970's	1980's	1990's
UPS wood coatings UPS building adhesives Acrylic flexographic plates	UPS wood coatings UPS building adhesives Acrylic flexographic plates	UPS wood coatings UPS building adhesives Acrylic flexographic plates
	Optical fiber coatings Optical discs coatings Adhesives for laminated glass production Dental resins Materials for printing plates Photoresists	Optical fiber coatings Optical discs coatings Adhesives for laminated glass production Dental resins Materials for printing plates Photoresists
		Acrylic wood coatings Jet inks LCD adhesives Aspherical lenses coatings

RAW MATERIALS

Table 2 summarizes the market data monomers, oligomers and photoinitiators. It reveals the range of commercial products as well as their annual growth rates for the consumption in 1991-1994.

As it is seen the domestic range of raw materials is extremely limited. For many years Russian plants have been making the simple acrylic monomers with no risk and no competition and as a result they have become complacent. The only plant to be reckoned is the acrylic plant, built by Japanese license, not launched since 1987.

In this particular situation the weak players should be weeded out and the growing demand of the RadTech customers could be satisfied by the import. From this point of view Russia is an unparalleled prospect for sales of western-made acrylic monomers and oligomers.

It should be mentioned, that the general falling down of raw materials manufacturing in 1991-1994 does have some exceptions. The growth of monofunctional acrylic monomers, urethaneacrylates and 2,2-DIPAPH photoinitiator manufacturing is connected with the wide promotion of the domestic urethaneacrylate adhesives in multilayer glass production technology.

Table 2. *Radcure Raw Materials in Russia*

COMMERCIAL PRODUCTS	VOLUME, M.T.			
	1991	1992	1993	1994
Monomers				
Acrylic Acid	1000	600	500	500
Acrylic Ethers Monofunctional (MA, BA, 2-EHA, MMA, BMA, HEMA, GMA, DMAEM)	1000	800	1200	1500
Acrylic Ethers Multifunctional (TGM-3, DMEG, TGM-13T)	8400	8400	7800	16400
Oligomers				
Unsaturated Polyesters	5100	3500	2800	2200
Polyesteracrylates (PEA 7-1, PEA 7-20, MGF-1, MDF-2, MGF-9, BPAEDM)	2000	1800	1200	700
Epoxyacrylates (EAS-20A, BISGMA)	800	650	400	200
Urethaneacrylates (UA-1052, UA-2102, UA-3502, UA-6003)	300	50	200	550
Carbonatemethacrylates (OCM-2)	100	80	45	15
Photoinitiators				
Irgacure 651	10.5	8.3	6.1	2.3
2,2-Diisopropoxyacetophenone	~	~	2	2.8

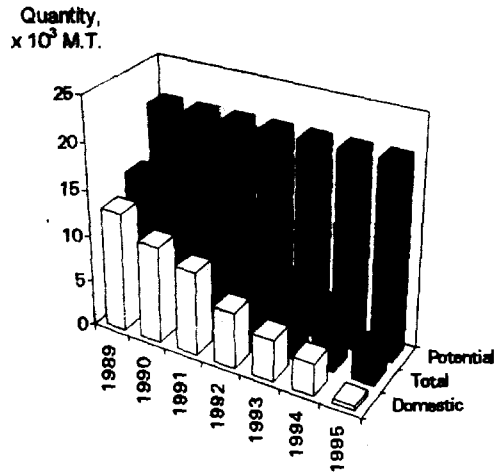
MAJOR USE SEGMENTS

HIGH VOLUME CATEGORY

Wood coatings

As described earlier the market of wood coatings is the major Russian radcure market.

There are about 120 UV process production lines (95 - are of foreign origin) at furniture plants. Their potential production capacity averages 750,000 square meters per year. Nowadays these production lines are charged not more than on 50% (Picture 1)

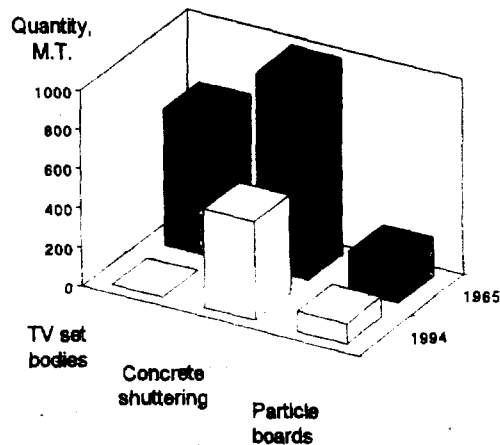


Picture 1. Utilization of Wood Coating Materials

The part of import materials becomes prevailed. Interim results this year likely to reflect recession of domestic market and the buoyant demand for import.

UPS systems have traditionally been the major basis for wood coating market. For time being they are being partially substituted by more sophisticated acrylic materials. However, the positions of UPS systems remain strong. The matter is that low quality of Russian wood materials hardly enables the usage of roll coating finishing technology for the front panels of furniture. As to acrylic curtain coatings, they are too expensive

As to EB formulations for wood, they were used mostly for finishing the TV set bodies and as adhesives for laminating particle boards and concrete shuttering. Nowadays these applications dramatically decreased (Picture 2).



Picture 2. Dynamics of EB Wood Coatings market

Glass laminates

Automotive, security, bulletproof and acoustic multilayer glass are widely produced in Russia by pouring UV formulations between two glass sheets and then curing with low pressure UV lamps through the glass. The technology successfully competes with lamination, using polyvinylbutyral (PVB) films, offering the possibilities of enormously reduced costing.

A novel photopolymerizable urethaneacrylate adhesive for glass lamination has been developed by DIPOL. It confers the excellent variety of properties (Table 3).

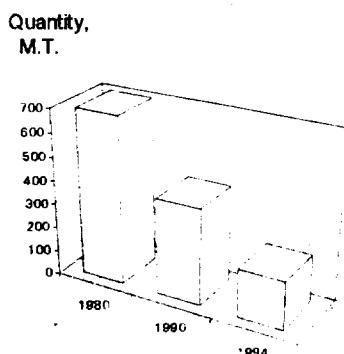
Table 3. *Properties of the Novel Urethaneacrylate Adhesives for Multilayer Glass Bonding.*

	+20°C	-20°C
Tensile Strength, kg/cm ²	336	295
Elongation, %	445	360
Volume Shrinkage, %	max 5	
Adhesion, MPa	min 10	

Its production enables to reach viable prospect for the Russian customers involved in this specific niche with the overall demand, surpassing 500 MT per year.

Photopolymer printing plates

Photopolymer printing plates (PPP) have become very popular in the Russian flexographic and letterpress printing since the beginning of 70's. Nowadays the shift towards web offset printing is noticeable. However, flexo printing liquid photopolymer systems are still used including some rather effective tap water washout systems. Declining of photopolymers demand is presented on Picture 3



Picture 3. *Utilization of Materials for Photopolymer Printing Plates*

LOW VOLUME CATEGORY

Table 4 describes the Russian market segments where UV/EB curable materials are used in the low volumes. The mostly growing areas among them are optoelectronic materials (coatings and inks for optical discs, fibers, lenses) and offset inks.

Table 4. *Areas of Low Volume application*

Application	Annual tonnage	No of installations
Offset inks for plastic lids	1	1
Screen print inks for CD	5	3
Jet inks	0.5	1
Photoresists	250	25
Conformal coatings	7	10
Aspherical lenses coatings	0.3	5
Videodiscs replicate coatings	0.4	2
CD protective coatings	6	3
Optical fiber coatings	20	8
Protective coatings for holograms	0.2	3
Dental restoration	2	6
LCD adhesives	0.3	2

Novel UV-curable monomers for optical coatings

At the beginning of RadTech boom Russian scientists had revealed that carbonate acrylates (CA) are extremely suitable for radiation curing (increasing reactivity, decreasing volume shrinkage). Some years ago we discovered also that multifunctional CA are characterized by drastically increased birefringence. It enabled the development of the specific range of monomers for optical properties with the unique variety of characteristics (Table 5).

Table 5. *Properties of the Novel Carbonate Acrylate Monomers*

Refractive Index	min	1.53
Birefringence	max	10 nm/mm
Volume Shrinkage	max	6%
Moisture Absorption	max	1%
Flame Retardance	min	V-1 according to the Vertical Burning Test
Impact Resistance	min	20 kg/cm
Scratch Resistance	min	5000 rev/min

FORECASTS, OPPORTUNITIES, PROSPECTS

No question the legal, technical, financial situation is rather vexing to the western companies. No wonder that import acrylic monomers have seen so little spot business. It is really difficult to recon on making an immediate profit or to commit profit to this field.

Nevertheless, the contrasts of Russia are as usually tremendous. The traditions, scientific potential, prospects of RadTech market were mentioned above. Moreover, two months ago Russia revamp its rules for foreign investors to facilitate their participation in its business. Mitigating circumstances appear in financial sphere also. To experience the vicissitudes of the Russian transport systems is not yet so risky.

DIPOL's strategy, focused on creating and strengthening the Russian RadTech market, is trying to take into account all these points.

CONCLUSIONS

1. THE BASIS FOR THE RUSSIAN RADTECH: Traditions
Scientific potential
Growing market
2. THE MAJOR RETARDING FACTORS: Lack of modern
radcure technologies
and acrylic monomers
3. DEBOTTLENECKING SOLUTIONS
 - A. The specialized retrieval of the potential radcure technologies and materials customers.
 - B. Establishing of joint ventures between customers from one side, suppliers of technologies and materials from other side