CURE OF POLYMERIC MATERIAL BY UV/EB RADIATION

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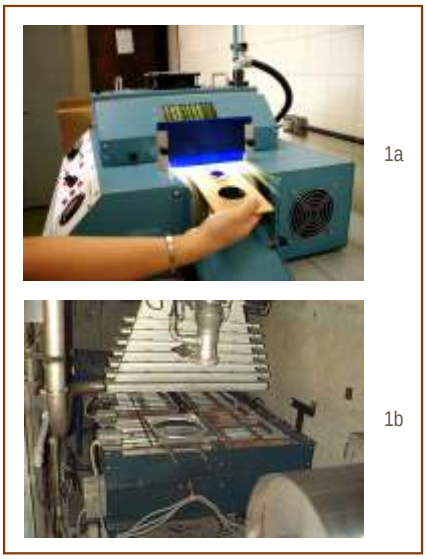
Accelerated Weathering of UV/EB Curable Clearcoats The cleaner technologies based on UV (ultraviolet), (FIG.1a) EB (electron beams) (FIG.1b) and visible light can instantly "cure" or dry specially formulated inks, coatings, and adhesives.



1a

1b

FIGURES 1a e 1b - Curing equipments

The research on clear coatings developed in the last years in CTR-IPEN have allowed us to correlate some parameters such as degree of cure and radiation doses with the degradation of the cured samples submitted to weathering process. This study provides data regarding the behaviour of four UV- and EB-curable clear coats - with and without light stabiliser additives - under accelerated weathering. The experimental data obtained from the weathered samples were evaluated and correlated to the formulation composition, type of radiation (UV or EB), radiation dose, and time of exposure in the weather-ometer chamber. (FIG.2) The ageing effects were evaluated by assessing parameters such as hardness, gloss, yellowness index, and changes in the Fourier transform infrared spectroscopy absorption bands.

FIGURE 2 - Weather-ometer chamber

The results show that the EB-cured films have a better resistance to photo-induced weathering effects than do UV cured films. Synthesis of A New Resin for Photocurable Electrical Insulating Varnishes Electrical insulating varnishes and wire enamels are products used as coatings in electric and electronic equipment as electrical and chemical barriers. Nowadays, the applied technology for these coatings is based on the use of thermally curable resins dissolved in 60 to 75% of organic solvents. Unfortunately, the use of these coating formulations generates VOC emission, toxicity, and high inflammability risk. Furthermore, the loss of organic solvent by volatilization during the thermal cure reduces the thickness of the coating film applied on the substrate surface. On the other hand, in ultraviolet (UV) or electron beam (EB) technologies of cure, the oligomers are dissolved in reactive monomers. In other words, the UV/EB curable products are comprised of 100% reactive components, which provides for environmentally acceptable coatings. UV and EB radiation curing are safe processes for the operating personal and also environmentally friendly technologies that save costs, energy and time. In the electrical and electronics areas, applications like soldering masks, photo-resistors, conductive inks, and development of flat wires for printed circuitry are examples of radiation-cured coatings usage. Up to now, there are no products in the market to be used as UV/EB radiation curable wire enamels or electrical insulation varnishes. One of the main problems for the replacement of the thermal cure process by the UV/EB technology is to obtain end products with similar electrical insulating, and chemical and mechanical barrier properties. It must be considered that these coatings have to attain continuous thermal life of 20 000 hours, at least, at temperatures in the range of 155 and 240ºC, without loosing its electrical insulating properties. The aim of the present work was to obtain and characterize a new resin based on unsaturated polyester diluted in acrylic monomer to be used in photo-curable electrical insulating varnish formulations. Curing at different UV doses and also UV/thermal dual-cure processes were investigated, looking for an improvement in mechanical and electrical properties of the cured films. Several resins were synthesized and tested. Finally, one of them presented the desirable performance. The specific test results show that the developed resin can be used in electrical insulating varnish formulations. The analyzed properties of UV cured samples are in the same range as those from air-drying varnishes. To improve them, a dual mechanism accomplishing UV and thermal curing is required. With this alternative, the side effects of conventional technology in electrical insulating varnishes are surpassed.