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# Excerpt from 'Control Techniques Guidelines for Paper, Film, and Foil Coatings' (US EPA document EPA 453/R-07-003 dated September 2007)

Radiation-cure coatings (also called prepolymer coatings) are a special type of reactive coatings. These coatings are cured by exposure to electron beam (EB) or ultraviolet (UV) radiation. Radiation-cure coatings are solventless and are almost entirely composed of resins. They are applied in a liquid state via some typical coating application methods (e.g., gravure and flexography), and polymerize into a solid state upon exposure to UV or EB radiation. UV-cured coatings require the addition of a photoinitiator to catalyze the polymerization reaction; EB-cured coatings do not, because the highly excited electrons emitted by the EB source are capable of initiating the polymerization reaction.

Benefits of radiation-cured coatings extend beyond decreased solvent usage and the associated emission reductions, including VOC emissions. The instantaneous nature of the curing process eliminates the need for drying ovens on the production line, which often leads to production increases and may allow direct integration of ancillary operations (e.g., cutting, slitting, folding) into the production line. Because no drying ovens are used, both energy usage and the space required for a coating line are greatly reduced. Since the coatings will not cure unless exposed to the proper type of UV or EB radiation, they will not cure on the production equipment during operation or during process downtime. As a result, it is not necessary to clean application devices at the end of each shift or during breaks and cleaning is easier than some other coatings, such as hot-melt coating.

Although industry generally perceives UV coating usage as expensive because it may be costly to switch a coating line from solvent-based coating equipment to radiation-cured systems, there are often savings with the use of radiation-cured coatings due to the above-mentioned benefits that can offset capital costs. Another industry perception is that the coatings themselves are more expensive. Although this may be true on a volume-to-volume basis, a radiation-cured coating will cover a much greater area of substrate (2 to 4 times) than an equal volume of a solvent-based coating because the radiation-cured coating is 100 percent solids and has no loss of volume due to evaporation of solvent.

There are, however, several limitations to the use of radiation-curable systems. The extent of cure penetration can be a problem if the coating is very thick or heavily pigmented, which could result in coating not being completely cured. Because low viscosity solvents are not used, application of the relatively higher viscosity radiation-cured coatings can be problematic; although this factor is less important in the application to web substrates than other substrates which use spray coating. Also, skin contact with radiation-cured coatings has the potential for irritation and/or allergic reaction. This is especially true during cleaning, since the combination of cleaning solvents and the radiation-cured coatings increases dramatically the level of irritation to the skin.