

Master thesis, UVC-LED curing, spring 2018

Background

UV-curing acrylate systems is the technology of choice in modern high speed coating lines, where instant curing and handling is required. The curing process is a fast (milliseconds) free radical polymerization process initiated by the excitation of a photo initiating molecule by UV radiation.

The Minamata convention states that the conventional mercury doped arc lamps used in the furniture and flooring coating industry today must be exchanged by mercury free alternatives in the near future. Building on a patent from professor Amano Akasaki, Nobel prize winner in physics year 2014, Japanese company Nikkiso have just recently developed UV-Light emitting diodes (LED's) generating short wavelength (e.g. 280 nm), high energy, UVC electromagnetic radiation without use of mercury. Commercial UVA-LED's emitting radiation at about 400 nm have now been on the market for several years, but the lack of short wavelength UVC radiation has turned out to be the limiting factor in the efforts to exchange mercury containing arc lamps for UV-LED's.

Tasks

- Initial literature study on the subject of UV-curing of acrylate systems to acquire general knowledge in radiation curing chemistry, especially on the emerging subject of energy curing using UV-LED's, and to compile the information into the final report.
- Hands on design and assembly of an experimental setup for evaluation of curing with a single light emitting UVC diode in combination with existing LED units, to investigate the future possibilities and limitations of UVC-LED curing of acrylate formulations used in the coatings industry.
- Evaluation and characterization of produced coating samples with methods that give insight into cross-linking densities and mechanical properties, and make comparisons with results for samples produced using conventional arc-lamp curing.
- Written report in English

Independent work is expected in all tasks, with continuous support and supervision from experienced personnel at Sherwin-Williams.

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