

Kerone Research & Development Centre (KRDC), Mumbai

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Experiment: Evaporation of ethanol from PU substrate by IR radiation exposure

Lab Machine: Continuous IR heating

Client: BARC, Mumbai

Criteria:

Substrate material	PU Plastic (Polyurethane film)
	Melting point range : 85°-121° C and Ignition Temperature : 416° C
Coating solution “Absolute Ethanol”	Flash point : < 23 ° C , Boiling Point : 78 ° C
	Polyurethane should not get shrinkage effect and fibers must retained in wounded structure (- temp limit 85 ° C)

Heat Flux: 9 kW

IR exposure length: 1400 mm

Experimental Set-up:



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S No	Set parameters	Results/ Analysis	Reason/ justification
1.	Temp : 100 degree C, Emitter Gain : 100% (PID controlled), Exposure time : 60 Sec, Sprayed Ethanol : approx. 24 ml (-by sterilized cotton)	Temp achieved 41.4 ° C on the substrate at the discharge point of machine	Absolutely evaporation of ethanol without degradation of PU, Action: To achieve lesser process time
2.	Temp : 100 degree C, Emitter Gain : 100 %, Exposure time : 60 Sec, MWCNT Powder and ethanol mix after sonication (Sprayed : approx. 24 ml)	Temp achieved 42.2 ° C on the substrate at the discharge point of machine	Quite good and to be considered as final result Reason : Nozzle was leaky and not able to spray the liquid at atomic level and uniformly
3.	Temp : 100 degree C, Emitter Gain : 100% (Manual mode), Exposure time : 60 Sec, MWCNT Powder and ethanol mix after sonication (Sprayed : approx. 24 ml)	Temp achieved 108.3 ° C on the substrate at the discharge point of machine	Imperfect and deformed (Image: Mentioned in the last page)
4.	Temp 100 °C, Emitter gain : 100% (PID Controlled), Exposure time : 60 Sec, MWCNT Powder and ethanol mix after sonication (Sprayed : approx. 24 ml)	Temp achieved 38.5 ° C on the substrate	Quite good result but having few undried patches due to uneven distribution by nozzle and the PU sheet had fed putting on SS plate and clamped for holding it during the entire heat zone.
5.	Temp 100 °C, Emitter gain : 100% (PID Controlled), Exposure time : 60 Sec	Temp achieved 48 ° C on the substrate	PU sheet is perfectly dried without deformation

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Picture of deformed sheet:



Picture of quite satisfactory sheet:



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Discussion Points for system design:

1. They requested for quotation along GA drawing of proposed system.
2. They also requested for air blower (- 6 numbers, 2x3 matrix) mounted on the top of IR cassette and they want to have individual control.
3. As per experiment conducted in our lab continuous IR machine, they are agreed to optimize the process parameters after the commissioning of system at their laboratory.

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