

THIN FILM COATING ON A STAINLESS ROLLER BY USING AN AIR-NOZZLE-BASED COATING SYSTEM



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Introduction

Purpose :

This paper presents an air-nozzle-based coating system for coating a micrometer-thick polymer layer on the roller.

Experimental Method :

The scheme of the coating system consists of three parts: a desktop lathe, polymer supply system and air jet system. First, a viscous polymer was dripped and spun by a syringe pump and the lathe rotation, respectively. Then, a high pressure air jet spray on the coated roller to flatten and thin the polymer layer by using a flat-shape air-nozzle. In order to coat different thickness of polymer layer, we can adjust proper operational parameters of air-nozzle-based coating system, such as the air pressure and the gap between nozzle and roller, etc.

Application :

Coating a thin polymer layer on the roller is a critical step for patterning the roller as a mold in the roll-to-roll (R2R) process. Therefore, this technology can be expected to apply for roller mold fabrication and other applications in flexible electronics.

Conclusion :

The thickness of coated layer on roller could be controlled by the gap between nozzle and roller and the air pressure. By varying these two parameters, the range of thickness of PDMS coated on the roller can be from 100 to 20 μm , furthermore, the roughness can be control under the 1 μm .

Air-Nozzle-Based Coating System

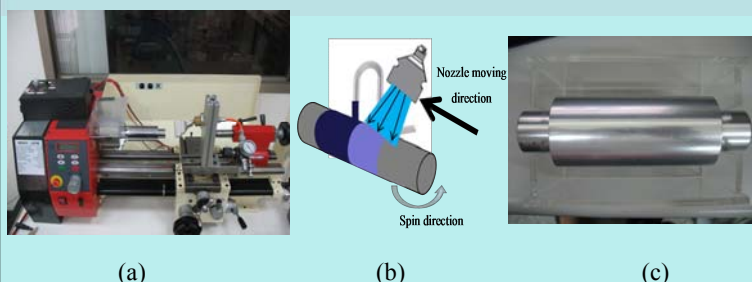


Fig. 1. (a) Experimental setup of an air-nozzle-based coating system on a lathe, (b) The mechanism for coating a thin film on the roller, (c) The stainless roller used in the experiments.

Table 1. The Operational parameters of air-nozzle-based coating system

Items	Condition
Materials	UV Gel, PDMS, PR
Viscosity (cps)	200 ~ 1000
Air Pressure (kg/cm ²)	0.5 ~ 6
Gap (mm)	0.5 ~ 50
Spray Angle (θ)	0 ~ 45(L/R), 0 ~ 45
Lathe Rotational Speed (rpm)	0 ~ 2000

Table 2. Viscosity coefficients and curing methods of coating materials

Materials	Viscosity (cps)	Curing Method
UV Gel	1000	UV Lamp
PDMS (transparent)	3900	Heater
PDMS (gray)	4000	Heater

Experimental Results

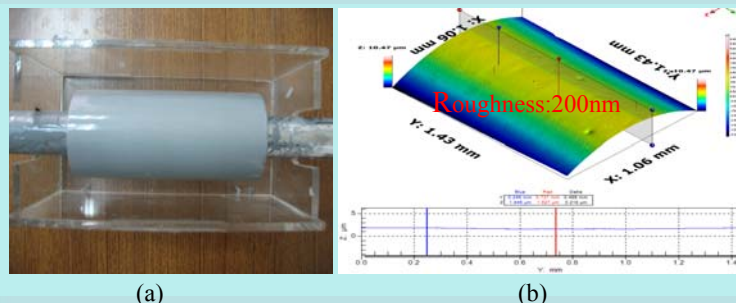


Fig. 2. (a) A roller coated with PDMS layer. (b) The roughness of PDMS thin film on the roller was measured by white light interferometry.

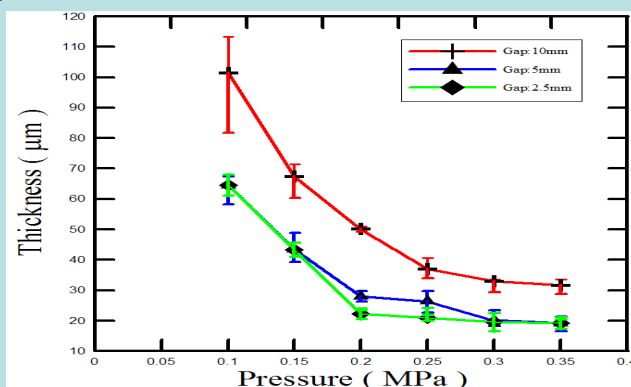


Fig. 3. The thickness of PDMS thin film on the roller for different air pressure and gap.