

# Production of Spin Coating Machine proscribed by Arm Processor for corporeal Studies of PVA

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## Abstract

*In this document describes, manufacture and working of more proficient and compactable spin coating apparatus with a low power utilization comparing to that of present spin coating machine obtainable in the market. The spin coating machine consists of stepper motor, syringe system, Dc brushless motor and Arm processor. The machine determination coat thin film in a micro level breadth and its spinning momentum and flow rate of the liquid has been proscribed by the arm processor (LPC 11U24). Breadth of the film is unwavering by the flow rate and covering time of the revolving machine. Films with good consistency for various thicknesses have been productively equipped by using above spin coating mechanism, a capacitor sensor has been fictional the above spin coating techniques and intentional their corporeal properties.*

**Keywords**—LPC 11U24, motor driver, PVA, spin coater.

## I. INTRODUCTION

At the present time thin film fabrication improves to expand all the applications and in all the fields, which makes up of slender film knowledge. All the micro stage devices, ICs and sensor are fictitious by thin film technology, which is extremely fewer in spacious and lower in power expenditure of devices. Chemical vapor deposition (CVD) is a chemical procedure used to manufacture high excellence, high-performance, solid materials. The expansion is often worn in the semiconductor industry to manufacture thin films. In typical CVD, the wafer is uncovered to one or more volatile precursors, which react and/or crumble on the substrate surface to manufacture the preferred deposit.

Thin film has been fictitious by many numbers. Of methods like Liquid-Phase Chemical procedure and Chemical Vapour authentication technique which is the most frequent technique for fabricating thin film. Categorization of the methods contains several electro processes such as involuntary Techniques Electroplating Spray pyrolysis Electro less plating Spray-on techniques Electrolytic iodization Spin-on techniques Chemical lessening plating Chemical dislocation plating Electrophoresis authentication Liquid phase epitaxial. Methodical misbehavior is grounds for dismissal of tenured ability, as well as for forfeiture of investigate grants. Given the tight-knit nature of many educational communities, and the high stakes involved, researchers who are found to have dedicated production are often successfully.

A more standardized coating thickness results in abridged coating expenditure, greater reproducibility

in presentation and interference fringes that are less noticeable. For spin coating, these interference fringes are less noticeable because they are in a symmetrical prototype of a few smooth, concentric circles.

### A. Spin Coating Instrument Model

Easy to exercise, safe and reasonably priced, this technique is extremely attractive for many applications where elevated excellence of layers is essential. Regardless of the process effortlessness, several investigational and academic investigations appeared in the literature amplification the confidence of the spin coating procedure on the electrical, optical and morphological uniqueness of the films. In such a way that the control of the fluid flow and the fluid evaporation are essential to meet uniform thin films. Since both contribute to the overall rate of the thinning during spinning of the fluid on the substrate. Still spin coating machine has control by PLC and FPGA processor but it quit costly, more or less spin coating machine is proscribed by physically, in this investigate work spin coating machine is full controlled by ARM workstation in very low cost, in market so many spin covering machines are accessible like KW Series, UF82 & LP384036TP, serious 2500S (PLC) based system, these are the some severe machine which has elevated cost, calculated spinning coating machine has too bendable less spacious and it coat thin film in standardized thickness. Using this mechanism a thin film distinguishing can be calculated in a various level like attentiveness, spin speed of this apparatus etc.

Film synthesis techniques used in the laboratory are based in substantial or substance vapor

authentication of thin films ('physical vapour deposition' or PVD and 'chemical vapour deposition' or CVD, respectively). In cooperation cases, the techniques are based in the formation of vapor of the material to be deposited, so that the vapor is condensed on the substrate surface as a thin film. Usually the process must be performed in vacuum or in controlled atmosphere, to avoid interaction between vapor and air.

### B. Film Preparation

The step-by-step grounding of a PVA thin film and the development is initiated by making a colloidal suspension, preparing substrates, and spin coating to make a template. The design and cleaning of substrates to prepare them for deposition is also described in, including details of the deposition procedure. The complications and results of depositing PVA under dissimilar conditions deals with the arrangement of samples and the mechanism designed. The structure of a spin coated colloidal pattern by spin coating a suspension is described in terms of thickness dissimilarity studies at special speeds.

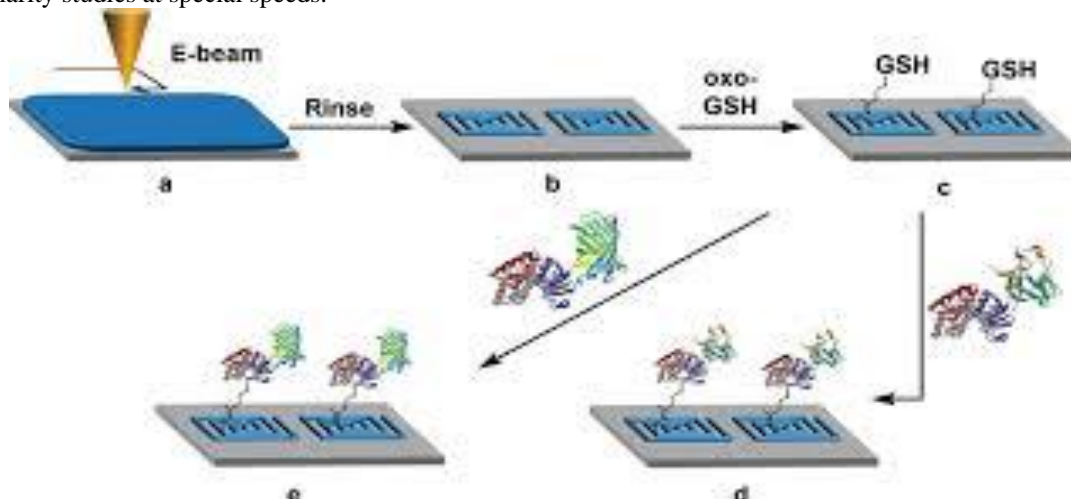


Figure 1. Block Diagram For The Spin Coating Machine

### B. Spinner with Motor and Mechanical Setups

The computerization and calculating are done using ARM LPC11U24 and motor driver L293. The mechanical rotor is detained in the centre soft of the motor axle by means of chuck. The mechanical rotor can hold the antenna plate or glass plate, with Appreciated to motor velocity a material has been encrusted over the glass substrate. The amplifier is most significant part in this machine, since the processor can recognize only 3.3 and delivery 3.3v only. But motor driver and other devices can recognize only 5v, motor drivers have to be enabling, and signal pin also 5v. So previous to give signal to diver must amplify productivity of the arm processor, for the amplification use MOSFET and npn transistor.

## II. WORKING OF SPIN COATING MACHINE

### A. Block Diagram Description

The spin coating machine is fully controlled by arm processor, which could be driven by driver circuit to drive a spinning motor. Each machine requires power supply; power is a major source of all devices. In this machine require 5v for the process operating and 14v for motor driver operating. The motor require 11v for its operating .when the driver is enable motor has been work. Power supply has contained transformer, rectifier, and regulator. All the devices have connection with arm processor, the provide voltage of a processor 5v, a processor allow greatest output voltage is 3.3v, its very low volt, a driver can appreciate only 5v so that a processor output voltage has been amplified by the amplifier, the processor output is Pulse width modulation depends on PWM output motor speed is control is shown in Fig. 1.

LCD's are obtainable in various shapes and sizes depending on the configurations. A 16x2 LCD shown in the image below be able to display 32 characters with 16 characters in each row. It is proficient to display any quality with ASCII values ranging from 0 to 255. A liquid crystal cell is sandwiched connecting alignment layers, electrodes, glass plates and polarizer's. The electrodes are used to be relevant voltage over the crystals. In general, the digital RPM is using automatically. Sensor as their element but this project want to expand using infrared sensor as their element, this particular IR sensor is not meaning as mechanical or other sensor but it is used to notice changing black and white colour, using this notion IR sensor has given as input for ARM

LPC11U24 to compute RPM of antenna. The LCD display is associated with arm processor which could be exhibit a speed of the motor, its operating voltage is 5v, LCD contain 8 bit data transfer pins and Rs choose pin, R/W,enable(EN) pin. These are major pins in the LCD; previous to connect LCD with processor it should be facilitating the end, Rs, R/W pins. Here two type of data association is there 8 bit and 4 bit, in this secession LCD has transport 4bit data transfer from processor. The LCD has been associated with ARM processor.

### C. Solvent Evaporation

Disappearance rate of the solvent for the procedure it is essential to have a solvent that evaporates fast at room warmth, like acetone or toluene. The film breadth depends on the evaporation rate of the solvent. The solvent is not evaporating, this means, the film thickness (d) depends only on the rotating speed ( $\omega$ ) and spinning time (t).

$$d = \omega^{-1} t^{-1/2} \quad (1)$$

The solvent evaporates with a constant rate.

$$d = \omega^{-2/3} \quad (2)$$

The solvent evaporation varies with the square root of the angular velocity.

$$d = \omega^{-1/2} \quad (3)$$

The overturn holds for the dependence of film thickness on angular speed. Spin Coating. Film thickness against angular rapidity by varying concentrations of the solution. The same dependence is obtained for the spinning time. The longer the spinning time is, the slighter gets the film thickness for constant spinning velocity.

Figure. 2 shows completely constructed spin coating machine. It has a greatest speed of 3000 rpm. First one has to twist on the “air-pressure” left to the left hood. Revolve the lever up. Then button on the vacuum pump in the left hood. The button is next to the spin coater. The spin coater itself does not have to be switched on, this works mechanically. Take off the top cover and place the substrate on the middle of the throw. Close the cover. Press the “start button”. Drop one milliliter of the explanation in the establishment rotation of the substrate. When the substrate with the polymer resolution is spinning for one minute, press the “stop button”.

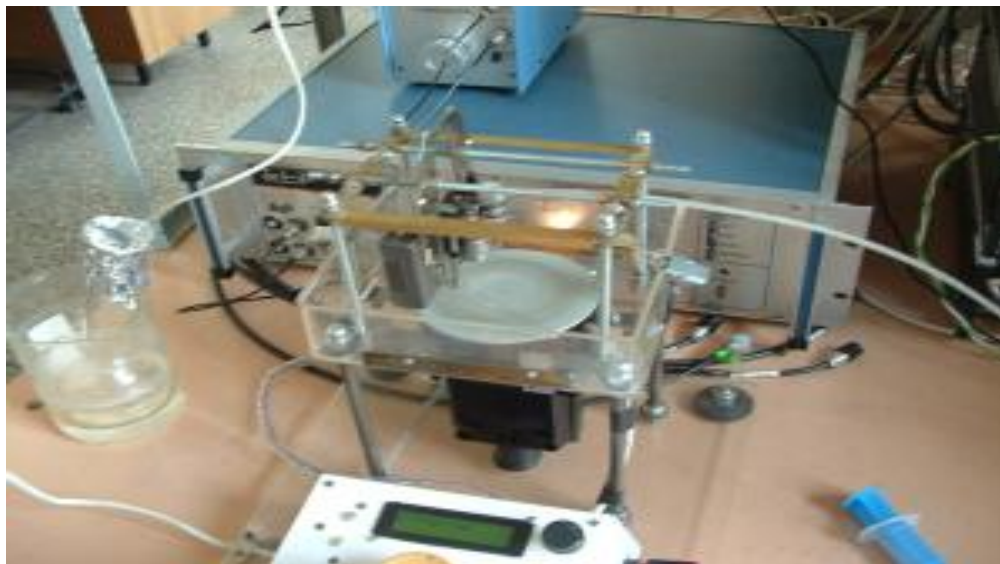


Figure 2. Constructed Spin Coating Machine

### III. SOFTWARE DESCRIPTION

The processor makes by NXP semiconductor company Mbed as a compiler for indoctrination, this processor occupation in Keil and mbed compiler. Mbed is a compiler which frankly works in internet. This software is user responsive; no require adding up library and correct devices. It can recognize assembly and c programming. It contains all libraries inherent.

While the program has been return, as it is stored in virtual memory. A curriculum is compiled it create bin file is stored into our processor unswervingly to USB.

### IV. RESULTS AND DISCUSSION

The constructed spin coating machine has an ability to rotate the substrate consistently at 1000 rpm, 2000 rpm and 3000 rpm. The PVA explanation is prepared by dissolving in the ration of 1:10. The

equipped PVA films have been studied for arrangement, dielectric properties. In the structural investigation XRD and SEM facilities were used. In dielectric characterization in variation of capacitance with occurrence (1MHz-5MHz) have been studied.

**A. Solvent Evaporation**

Accurateness, sensitivity, reproducibility, are the parameters has been studied for this machine for more than 20 samples has taken, more or less all the samples coated in uniform thickness and a film formed show the capacitance with respected to thickness of film. It worn for collect more than one sample at a time, even the machine has quit better reproducing ability for uniform film thickness in this machine.

**B. Structural Characteristic of PVA XRD of PVA Film**

The XRD has been taken for spin coated PVA thin films coated over the AL substrate XRD pattern of pure PVA film has been recorded. The observation of the maximum intensity diffraction peak at  $2\theta=19.8^\circ$  corresponding to d spacing 4.4801Å, indicated the presence of a typical semi crystalline structure and the maximum intensity diffraction peak of aluminum at  $2\theta=44.8$  65.3 and 78.4 it consistent with earlier studies. The XRD pattern of the pure PVA has indicated the presence of crystalline behavior, in agreement with the results reported earlier.

The slim film surface morphology and practical group of PVA was characterized by means of scanning electron microscope (SEM). The Fig. 4 shows the SEM images of PVA. The PVA thin film has a great smooth area, representing formation of transparent film, which has coated by spin coating technique and cubic arrangement has been formed in the coated film, the structure of image has been shown in the Figure. 3.

**C. Study of Physical Characteristic of Spin Coated PVA Film**

The PVA thin film from 10wt% solution concentration has been fabricate in protected environment with the assist of zig for removing moisture in the air and uncleanness. First the polymer has dissolved in a solvent, depends on material the solvent has been diverse, after the preparing explanation has kept over a spinner on electrolytic material, when the apparatus gets ongoing with respected motor speed and coating timing, the thickness of thin film also get diverse.

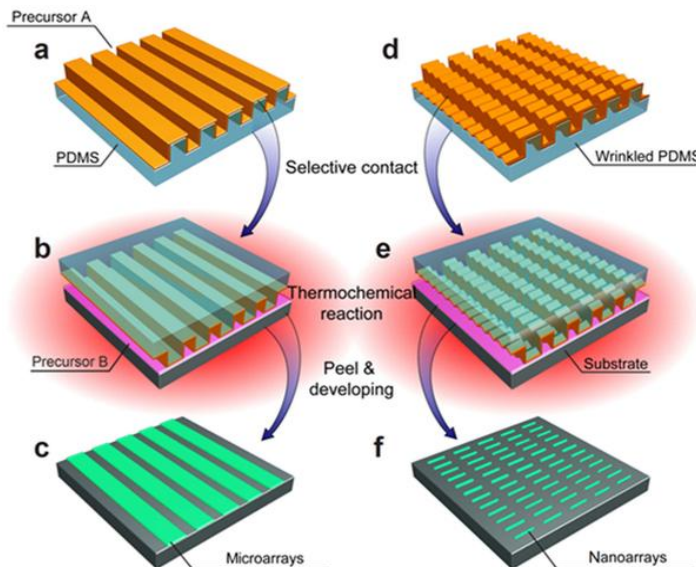


Figure 3. SEM image of Spin Coated PVA Thin Film

The component is fundamentally a pure reactance. Measurement accurateness can be pretentious by choosing the wrong measurement occurrence, measurement model, or trying to calculate a part whose value is out of the meter's variety. Small capacitors with low debauchery D values are normally easy to calculate with the parallel. Small capacitors with low debauchery D values are normally easy to calculate with the parallel. In the graph capacitance regularly increases of frequency and decreases unexpectedly at (D=6.03) when the quality factor has been decreased for the reason that of high frequency, the graph drawn below Figure. 4 is shows sudden difference, when the 'D' factor Increases.

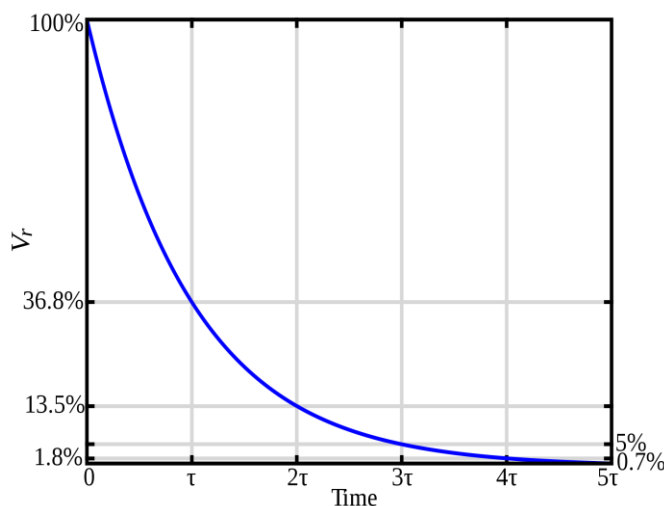


Figure 4. Capacitance Responses For Frequency



## V. CONCLUSION

The spin coating machine has been constructed using ARM Processor LPC 11U24 and controlling using motor driver L293. The mechanical system with chuck is designed and experienced which holds the rotor axle of the speed. The speed is monitored and proscribed by the ARM processor calculating segment. The design of spin coating using the ARM Processor gives more precise calculating signals for standardized various scheming speeds from 1500 rpm to 3500 rpm. The augment of capacitance with amplify of frequency up to 3MHz occurs due to the direction of dipoles. The unexpected diminish of capacitance above 3MHz is due to non-orientation of dipoles occurs in the high frequency assortment in the polymer film. The PVA solution of dissimilar concentrations has been equipped and the PVA thin films are coated over the Al substrate using the above spin coating machine. Then Al/PVA/Al structure is worn for dielectric characteristics. The structural area of the film is 1cm x 1cm, which is used for dielectric studies.

This spin coating machine is more resourceful for different attentiveness of the resolution which can produce good in reproducible, easy to handle and fully mechanical and lower cost of films. The restriction of this machine is that we can't enlarge the rpm more than

3500 because of controlling signal, motor driver and for the reason that of motor.

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