International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 05 Issue: 05 | May - 2021 ISSN: 2582-3930

SYNTHESIS OF CUO/PVA THIN FILM ON BY USING DIRECT PRECIPITATION METHOD

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ABSTRACT:

In this research work CuO/PVA thin film were synthesized by using solution casting method. Cupric acetate and sodium hydroxide were used as a precursor. In this process various technique and methods are used to analysis the CuO/PVA thin film for characterization technique. Finally, we had characterized CuO/PVA thin film by using UV-spectroscopy and SEM analysis. we can observe the peak and the range of CuO solution is 300nm wavelength and 370 peaks has proved and the range of CuO/PVA solution is 300nm 376 peaks has proved by using solution casting method. SEM analysis we can observe the image says 10µm range in 5000x for CuO/PVA thin film we can observe 20 µm range in 1000x and 50µm range in 2000x.

KEYWORDS: CuO/PVA thin film, direct precipitation, characterization and applications.

1. INTRODUCTION:

Nowadays,variety of fields like nanoscale CuO has sparked a lot of research interest in recent years on technology and research[1]. Copper oxide got attraction progressively interest for both fundamental and practical reasons [2]. CuOcategorized into transition metal oxide group, is a p type, narrow bandgap semiconductor [3]. Different methods were used for the synthesis of CuO nanoparticles such as sol-gel, solid-state reaction, microwave irradiation, and thermal decomposition [4].

Copper oxide act as a semiconductor metal which has various properties such as unique optical, electrical, and magnetic properties [5]. And also, it has been used for many applications like near-infrared filters,

improvement of supercapacitors [6], magnetic storage media [7], gasand biosensors [8,9], catalysis [10], semiconductors, etc [4,11]. Few researchers have explored the effect of Copper oxide on lubricating oils along it displays promising results [12].Transition metal oxide like copper oxide (CuO), iron oxide (FeO), and zinc oxide (ZnO) nanomaterials had different physicochemical properties rising at the quantum size effect and also high specific surface area. which had different from atomic or bulk components [13].

Copper along its complexes has been increased which have effective materials for purification of water, textiles, etc. Dhaneswar Das et al says Copper oxide nanoparticles are stable and also have a longer life related to organic antimicrobial agents [14]. Environmental and biological risks on copper nanoparticles have been explored by many researchers [15].Different types of polymers (like polyvinyl alcohol, polyethylene, polyvinylidene fluoride, polypropylene, polymethyl methacrylate, polyaniline, polyvinyl chloride, polyamide, polyethylene terephthalate, polystyrene, etc.) composites are carried with different types of nanofillers such as (CuO, ZnO, ZnS, CuS, CdSe, Cds, GO, FeO), etc. [16,17,18].It provides that the inorganic addition of polyvinyl alcohol (PVA) modified its properties [19]. Polyvinyl alcohol (PVA) was synthetic, colorless, water-soluble polymer [20].

PVA is a semi-crystalline hydrophilic polymer it has a 1,3-glycol structure. It is used to incorporate copper oxide nanoparticles as long as in water-soluble, transparent, highly durable, and suitable for the environmental processes because of its biodegradability and non-toxicity [21]. In this paper composite films were characterized using different analytical techniques along with effect in copper oxide NPs and film has properties [22].

PVA is a semi-crystalline hydrophilic polymer it has a 1,3-glycol structure. It is used to incorporate copper oxide nanoparticles as long as in water-soluble, transparent, highly durable, and suitable for the environmental processes because of its biodegradability and non-toxicity [23]. PVA (polyvinyl alcohol) has been the most widely used water-soluble polymer in a variety of applications [24].PVA polymer is a potential material with strong charge storage ability, high dielectric strength, and dopant-dependent electrical and optical properties [25].

PVA–CuO thin flim are used for hybrid nanofluid for heat transfer application,The polyvinyl alcohol (PVA)/ copper oxide (CuO) nanocomposite used for highly stable hybrid nanofluid by the sol-gel method [26]. The

CuO / PVA nanofluid is synthesized by a two-step technique, just to reveal the result that increases in the concentration of nanofluid with the increased value of absorbance [27]. The CuO-PVA nanofluid samples can be used successfully for any heat transfer management systems in industrial applications.[28].

2.EXPERIMENTAL SECTION:

2.1 MATERIALS:

Synthesis of Copper Oxide nanoparticles by using direct precipitation method, in this research paper we use copper acetate solution (0.2M), acetic acid (1ml), and Sodium hydroxide solution (NaOH), and PVA solution was purchased from Eswarr Scientific & Co in Tamil Nadu, India. According to this process, all chemical compounds are dissolved with distilled water (DI) to produce a precursor solution.

2.2 SYNTHESIS PROCESS:

2.2.1 CuO NANO PARTICLE PREPARATION:

In this work, copper oxide nanoparticles were prepared by using the precipitation method by using copper acetate solution and then sodium hydroxide (NaOH) as a reducing agent. Then add 0.2 M copper acetate solution (300ml) and take acetic acid 1ml were added at bottom flask and heat at magnetic stirrer. Pour sodium hydroxide (3M) at 15 ml of DI water. While stirrer the solution color turned from blue to black immediately. The black suspension formed simultaneously. The reaction was carried out under stirrer at 3 hr and then cooled at room temperature. Finally, the solution was filtered at what's man filter paper then collect the particles and placed at Petri plate. Placed the Petri plate in a hot air oven at 80 0 C for 8 hr to obtain the dry powder of CuO nanoparticles. The result prepared of CuO nanoparticles was 75%.

$$CuO + 2NaOH \rightarrow Na_2CuO_2 + H_2O$$

2.2.2 CuO/PVA THIN FILM PREPARATION:

Preparation of CuO /PVA thin film was prepared by using the solution casting method. Take PVA stock solution (1g) at 10ml of water mix it well by using a magnetic stirrer at 550 C heat. Then add CuO nanoparticles (1wt) were mixed and stirred until PVA/CuO solution was obtained. Finally, CuO/PVA solution was blended and then poured on a glass plate, and let dry at room temperature for about 48 hrs. After dry peeled off from the glass plate. Placed the thin film in a zip lock cover.

3.FLOW CHART:

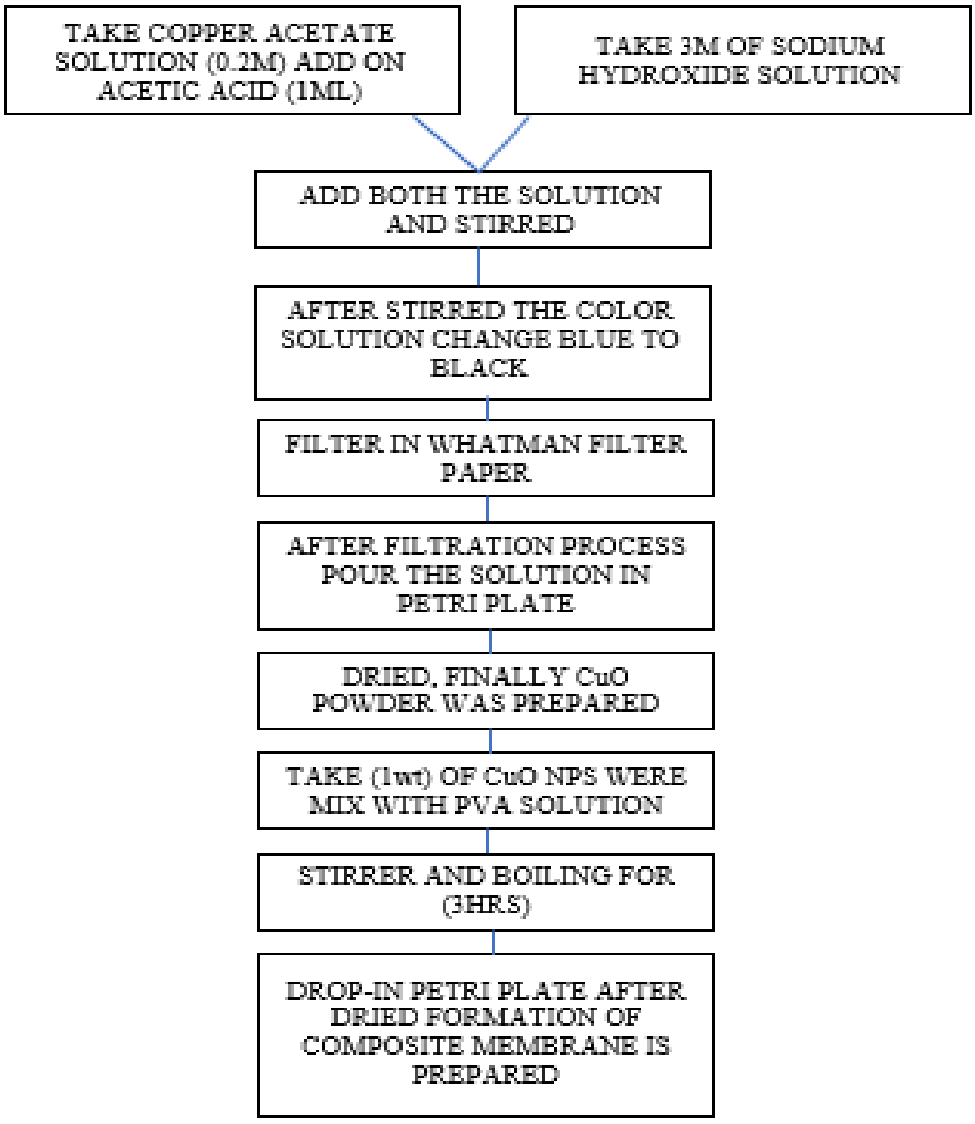

Fig 1:This flow chart represents the synthesis process of CuO/PVA thin film.

4.CHARACTERIZATION:

4.1 UV-VISIBLE SPECTROSCOPIC:

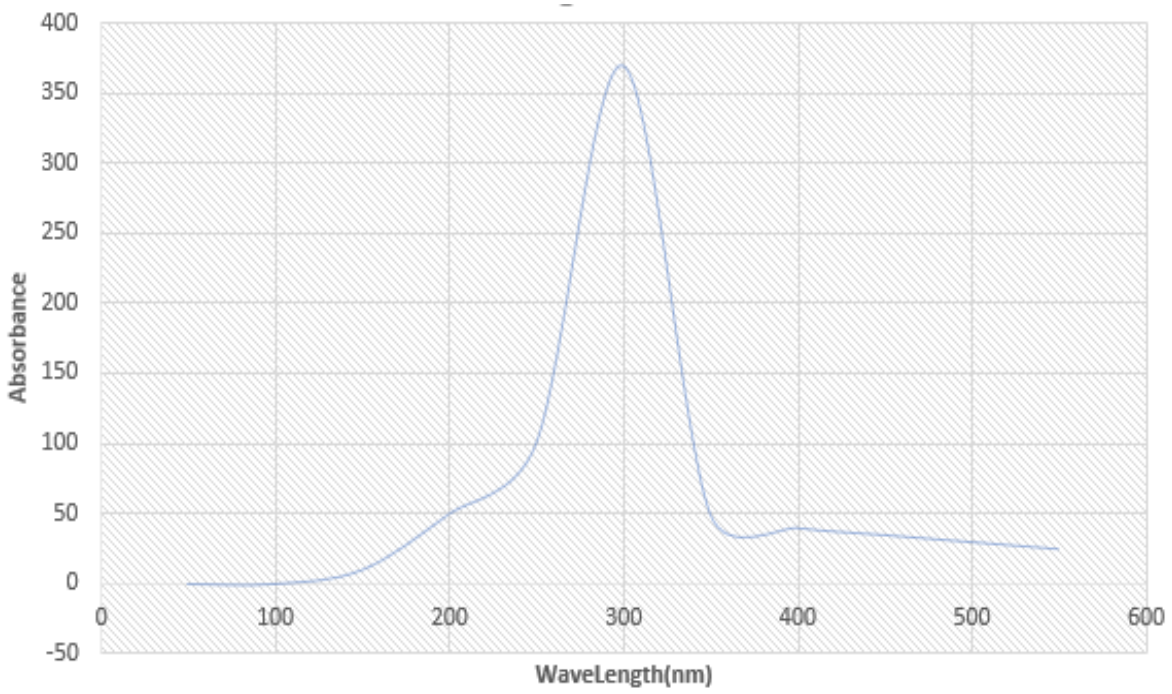

Fig 2: uv-spectroscopy of CuO nanoparticle.

In this UV spectroscopy, we can observe the peak of CuO nano particals is 300nm wavelength. Which has the formation of copper oxide nano particles by using the solution casting method.Purushottamkumarsinghet all.[29] said that range was set between 200 and 800 nm of copper oxide nano particals in this absorbance. V. Ramani et all [30].Said that the UV-visible spectrum is shown the present in the spectrum by dip from which present the absorbance in the range of 300 to 350 nm. Beyond this, the absorptance is zero initially, with no small peaks or dips in the spectrum.

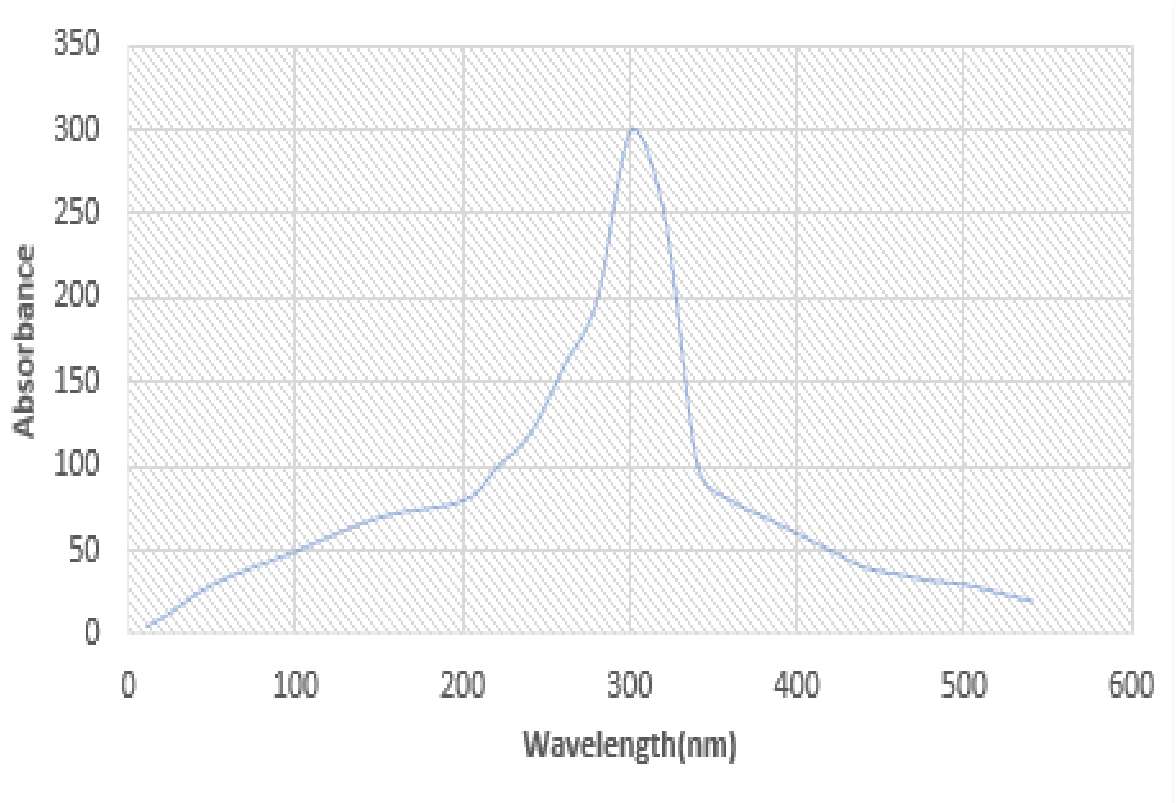

Fig 3: uv-spectroscopy of CuO/PVA solution.

In fig 3 UV spectroscopy the absorption spectra have clearly explained, we can observe the peak and the range of CuO/PVA solution is 300nm has proved by using the solution casting method. Above copper oxide nano particles shows the range 300nm by comparing CuO/pva peak shows in 300nm Both CuO and CuO/PVA peak range has equal because the uvlight is observe only by copper oxide nano particle.

5.2 SEM ANALYSIS:

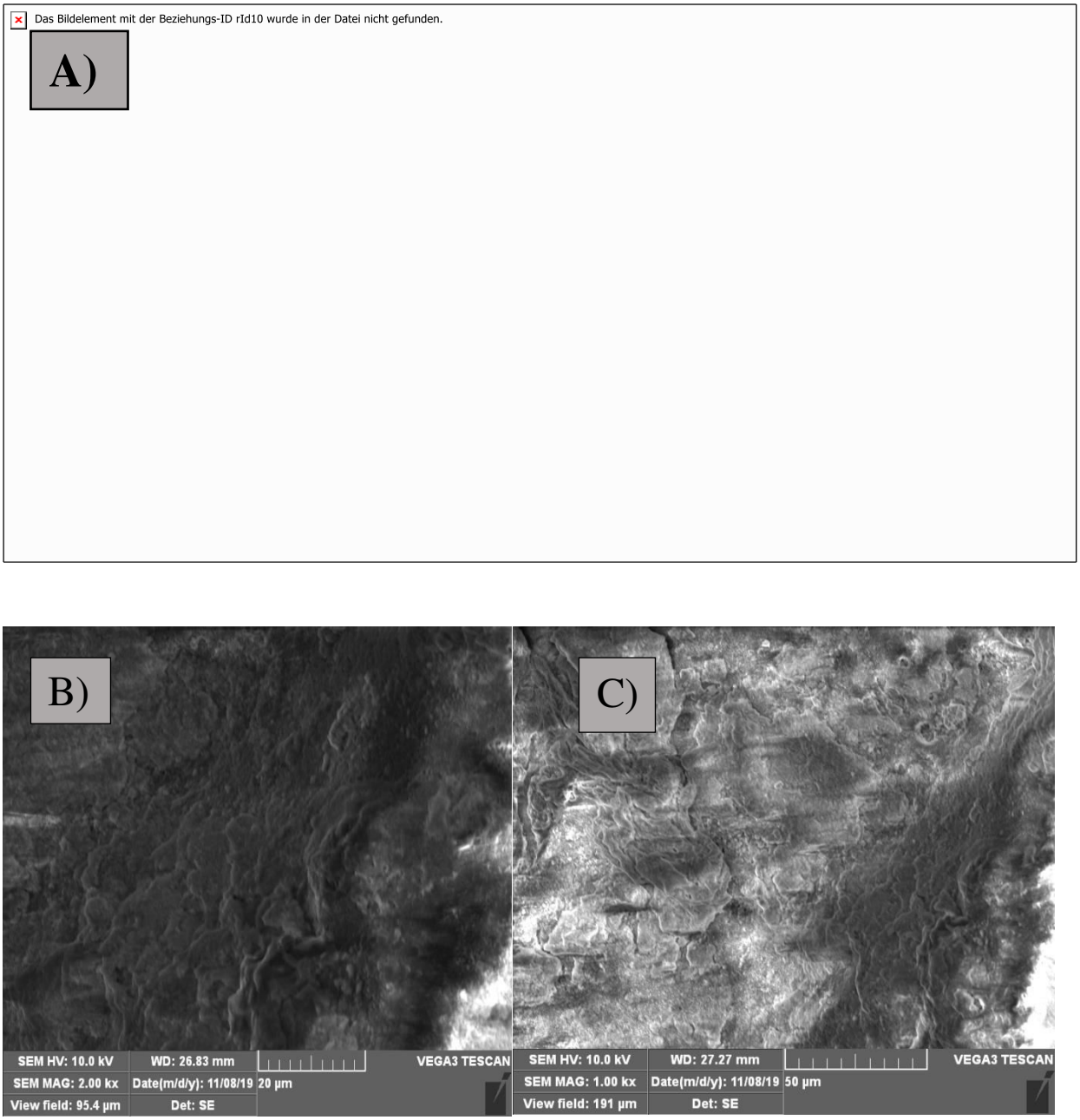

Fig 4: SEM photography of CuO nanoparticle and CuO/ PVA thin film.

Fig 4: In this scanning electron spectroscopy, we can observe in fig 4 (A) represent the morphology of CuO nanoparticles. CuO nanoparticles agglomerated shape of crystals on carbon-coated copper grid. The CuO nanoparticles have analyzed at 10µm range in 5000x. It shows the agglomeration of the CuO nanoparticles. We can observe in fig 4 (B) and (C) represent the morphology of the CuO/PVA thin film. The CuO/ PVA

thin film has analyzed at 20µm and 50µm range in 1000x respectively. It shows the high tendency of agglomerations in this method. This observed agglomeration could play a vital role in the properties of the target materials such as variation in electrical conductivity due to the change in specific surface area.

7.CONCLUSION:

In this work, it has focus on CuO nanoparticles and we combine with PVA to form a nanostructured thin film which is widely applicable in various applications because of its interesting properties. In short, we elucidate the CuO nanoparticle synthesis process and its various applications. The synthesizing process, characteristics, and the properties of CuO nanoparticle is the basis for understanding the applications of CuO nanoparticle. The CuO nanoparticle can be synthesized in various forms such as Nano powder, scaffold, nanowires, nanorods, etc., when the structure changes some of its properties will also differ.

ACKNOWLEDGMENT:

I would like to thank Nanotechnology Division, Department of Electronics and Communication Engineering of PeriyarManiammai Institute of Science and Technology for providing necessary materials and supports for do this work.

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