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Optical and Morphological study of modified polyvinyl alcohol conjugates

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The optical and morphological characterization of modified polyvinyl alcohol conjugates and doped modified polyvinyl alcohol samples were studied. The bands are shifted towards the higher wavelength as the modification in PVA and doping of modified PVAs, the values associated with these transitions. Since photoconductive polymer shows red shift in formal peaks. With modification and doping the surface morphology of PVA is changed.

Keyword: MPVA and DMPVA, SEM and UV-Visible spectra.

1. Introduction

Polyvinyl alcohol (PVA) is a polymer with several interesting physical properties, which are very useful in technical applications. PVA as semicrystalline material exhibits certain physical properties resulting from the crystal-amorphous interfacial effect [1]. Moreover, it contains a carbon backbone with hydroxyl groups attached to methane carbons. These hydroxyl groups can be a source of hydrogen bonding, hence the assistance in the formation of polymer blends [2]. Different additives are usually added to polymer in order to modify and improve its properties. Inorganic additives such as transition metal salts have a considerable effect on the optical and electrical properties of PVA polymer [3]. Manganese is well known as a magneto-active multivalent element; thus its halides can be used as fillers to modify the electric conduction and optical absorption of PVA. On the other hand, $MnCl_2$ is considered a good candidate for one or two-dimensional phenomena [4] and for optical memory devices [5]. Silver was added to PVA matrix due to a good prospective photoelectric and thermoelectric material and many works have been done on it [6]. PVA is an efficient binder for solid pigments, ceramic products, plastic, cement, fibers, non-woven fabrics, catalyst pellets, cork compositions etc. Also, PVA has gained increasing attention in the biomedical field due to its bioinertness [7].

The non-ionic polymer 2HEC is used in personal care applications, as its use in hair shampoo to satisfy many functions. Also, it's used to thicken shampoo, reduce foaming and enhance the cleaning capability by forming collides around dirt particles [8] as well as a viscosity modification in paints and cosmetics [9]. Blending PVA with other polymers may offer opportunities to modify the physical properties improve the processability and lower the cost [10]. Polyvinyl alcohol (PVA) as an important water-soluble polymer is widely used in synthetic fiber, paper, textile, coating, and binder industries due to its excellent chemical and physical properties, nontoxicity, processability, good chemical resistance, wide range of crystallinity, good film formation capacity, complete biodegradability and high crystal modulus etc. [11]. PVA is used in fully hydrolyzed form with degree of hydrolysis 98-99%, and partially hydrolyzed form, with a degree of hydrolysis of approximately 85%. Fully hydrolyzed PVA is generally used in fiber production. The fully hydrolyzed form has been used in this study. The

molecular weight and distribution of polyvinyl chains strongly affect the chemical and physical properties of PVA [12-13].

Although PVA has good mechanical properties in the dry state, its applications are limited in wet state. Chemical and mechanical properties of PVA can be drastically changed by cross-linking. For example the increase in the degree of cross-linking can result in the disappearance of the melting point, decrease in the solubility, and increase in the tensile strength of the resulting polymer. PVA can be cross-linked using physical techniques such as heat treatment and radiation or chemical agents such as haxamethylene or hexaethylene diisocyanate, glyoxal, boric acid etc. Boron is used as a cross-linking agent in this study since boron improves the strength, flame retardant characteristics and flexibility of the resulting electrospun fibers. The crystallinity of the crystal structure is reduced with cross-linking. The melting point disappears when PVA fiber aggregates are fully cross-linked [14-17].

Literature Survey reveals that the demands improvement of different properties of various form of MPVA materials. In the present research work, the optical and morphological study MPVA and DMPVA were studied.

2. Materials and Method

The newly synthesized modified PVA and Doped MPVA is recrystallized in methanol**.** The UV-Visible spectra of MPVA and doped MPVA were recorded on Shimadzu UV-1800 spectrophotometer, thin films by placing an uncoated identical conducting glass substrate in the reference beam in the range of 200 to 800nm and SEM will studied by Philips XL 30 SEM system

3. Result and Discussion

3.1 UV-Visible spectroscopy

A plot of absorption coefficient verses wavelength for all synthesized samples shown in Figure 1 to 3, Wavelength for maximum absorbance λ_{max} and corresponding optical band gap for all samples are presented in Table 1, 2 and 3.

Photoconductive polymers have a conjugate system of double bonds on their backbone. The photoconductive polymers have some of the conventional transfers in the UV-visible region, such as σ-σ*, Π-Π*, n-Π* etc. The σ-σ* transition of conjugated double bonds are related to near UV regions around 200 nm, UV-visible spectra of the spectrum of pure PVA is characterized by an absorption edge at wavelength 277 nm. No absorption peaks are noticed at higher wavelengths. This absorption edge can be attributed for carbonyl groups conjugated with one ethylinic group [18-24]. These bands are shifted towards the higher wavelength as the modification in PVA doping of modified PVAs, the values associated with these transitions are shown in Table-1, 2 and 3 Since photoconductive polymer shows red shift in formal peaks.

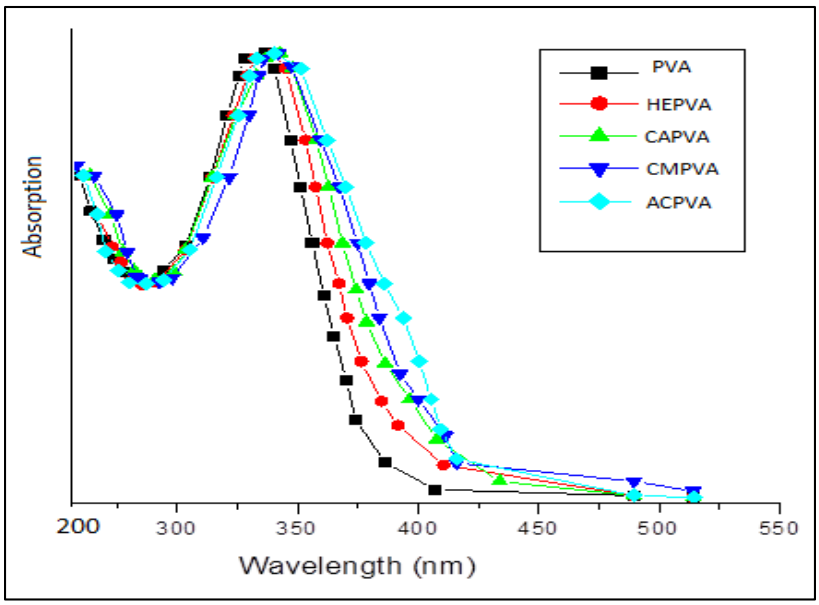

Fig 1: UV-Visible Spectra of pure PVA and MPVA

Table 1: UV-Visible spectral data MPVA.

Materials	λ_{max} nm		Electronic Transition	
PVA	-	277	-	n-Π*
HEPVA	-	340	-	n-Π*
CAPVA	259	344	Π-Π*	n-Π*
CMPVA	263	346	Π-Π*	n-Π*
ACPVA	266	348	Π-Π*	n-Π*

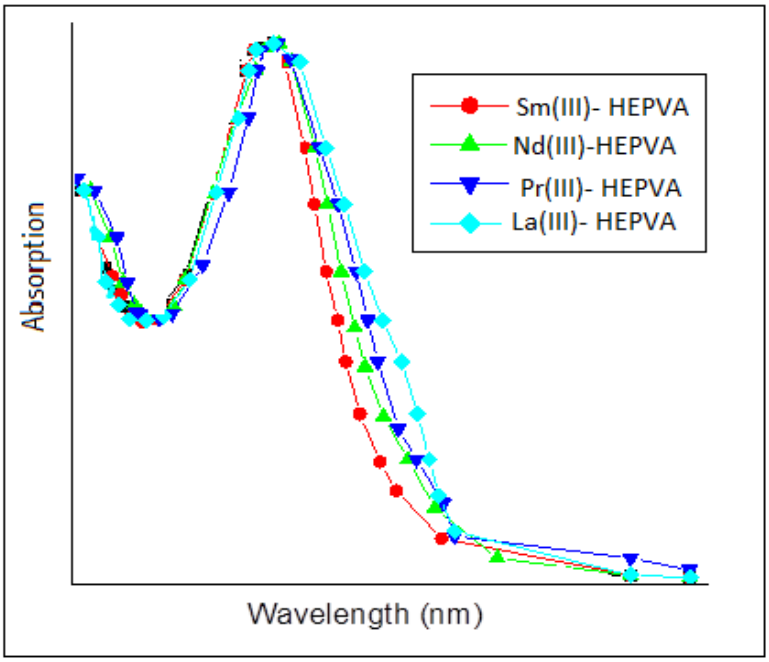

Fig 2: UV-Visible Spectra of DOPED HEPVA

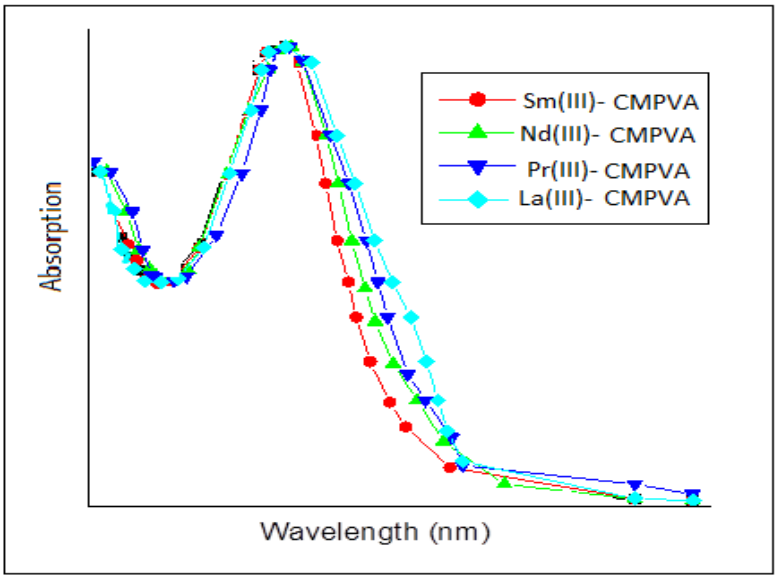

Fig 3: UV-Visible Spectra of pure DOPED CMPVA

Table 2: UV-Visible spectral data doped HEPVA.

Materials	λ_{max} nm		Electronic Transition	
HEPVA	-	340	-	n-Π*
HEPVA-La(III)	-	352	-	n-Π*
HEPVA-Pr(III)	-	350	-	n-Π*
HEPVA-Nd(III)	-	347	-	n-Π*
HEPVA-Sm(III)	-	345	-	n-Π*

Table 3: UV-Visible spectral data doped CMPVA.

Materials	λ_{max} nm		Electronic Transition	
CMPVA	263	346	Π-Π*	n-Π*
CMPVA-La(III)	272	355	Π-Π*	n-Π*
CMPVA-Pr(III)	271	351	Π-Π*	n-Π*
CMPVA-Nd(III)	270	350	Π-Π*	n-Π*
CMPVA-Sm(III)	267	348	Π-Π*	n-Π*

3.2 Scanning electron microscopy (SEM)

Scanning electron microscopy (SEM) is an important tool to investigate the surface and morphology of the phosphor materials. By using it we can estimate the diameter, length, thickness, density, shape and orientation of the phosphor materials. (SEM) photographs of MPVA and doped MPVA is shown below,

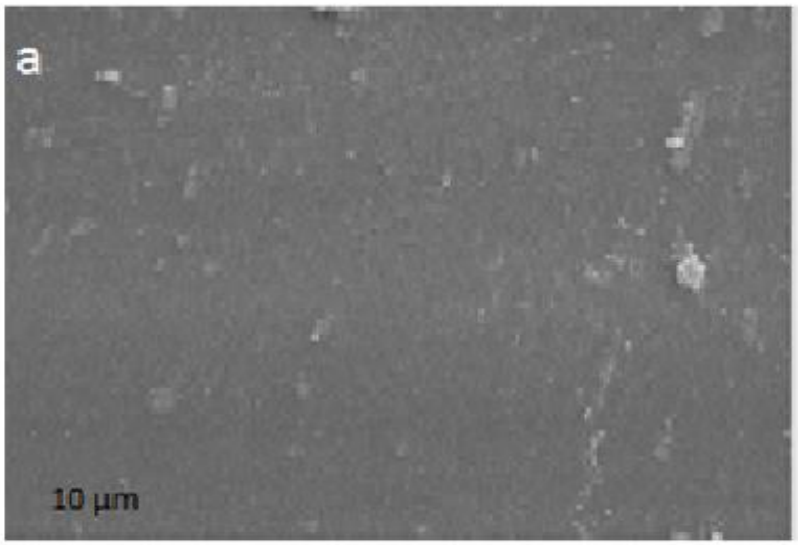

Fig 4: SEM image Pure PVA

The SEM photograph of pure PVA is shown in figure 4, the PVA was uniform surface with minor particles was observed the size varies from 1 µm to 100 µm in length. It was observed that no more effect has done on surface morphology with modification of PVA as shown in figure -5. The SEM photograph of doped CMPVA is shown in figure -6, the doped CMPVA show that number of voids are present in the field and voids size are almost same over entire surface voids size are very small varies from 1 µm to 100 µm. The SEM photograph of doped HEPVA is shown in figure -7, the doped HEPVA show remarkable change in structure morphology size of voids varies from 1 µm to 100 µm.

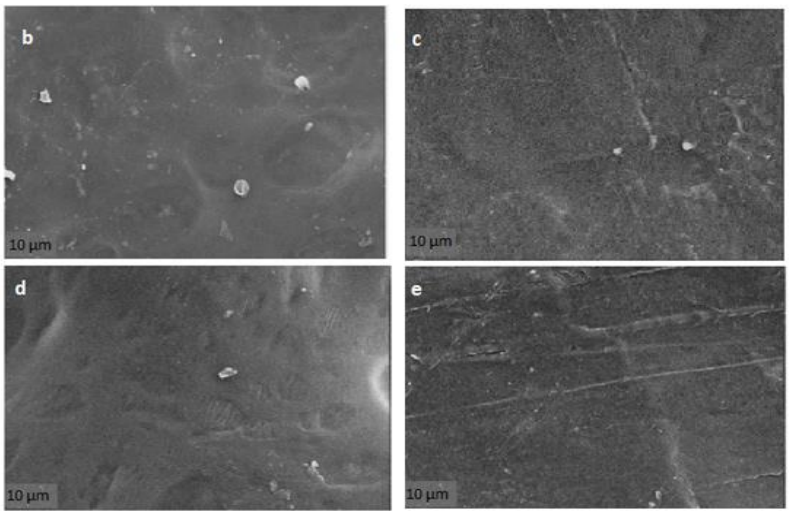

Fig 5: SEM image Modified PVA

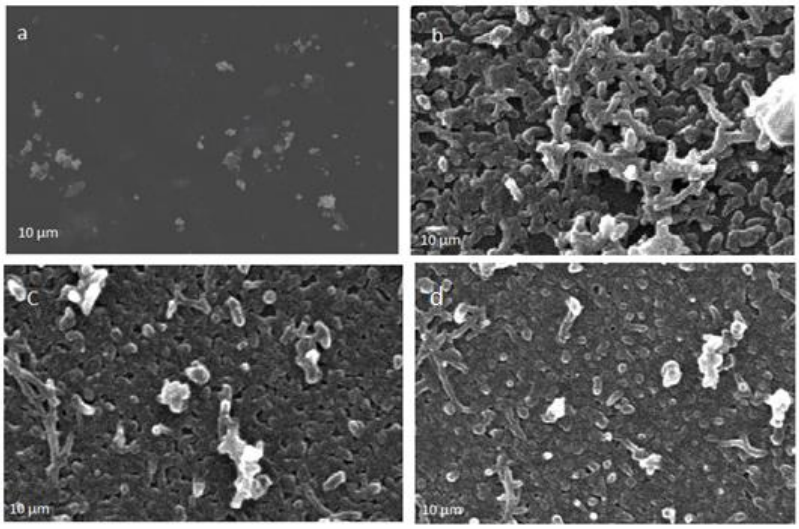

Fig 6: SEM image Doped CMPVA

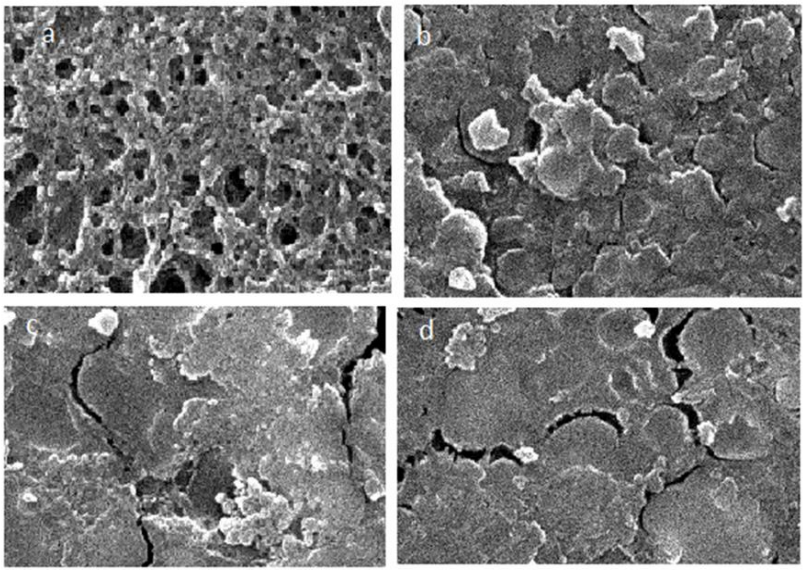

Fig 7: SEM image Doped HEPVA

4. Conclusion

The bands are shifted towards the higher wavelength as the modification in PVA and doping of modified PVAs, the values associated with these transitions. Since conjugated polymers shows red shift in formal peaks. With modification and doping the surface morphology of PVA is changed.

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