قسم الفيزياء
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microwave plasma-induced changes in optical properties of PVA films

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Introduction

- **Microwave discharges (MD)** are the electrical discharges generated by the electromagnetic waves with frequencies exceeding 300 MHz, ,The frequency 2.45 GHz is the most used.
- Recently **microwave oven** have been used successfully in make microwave system for surface modification of polymers and fabrics
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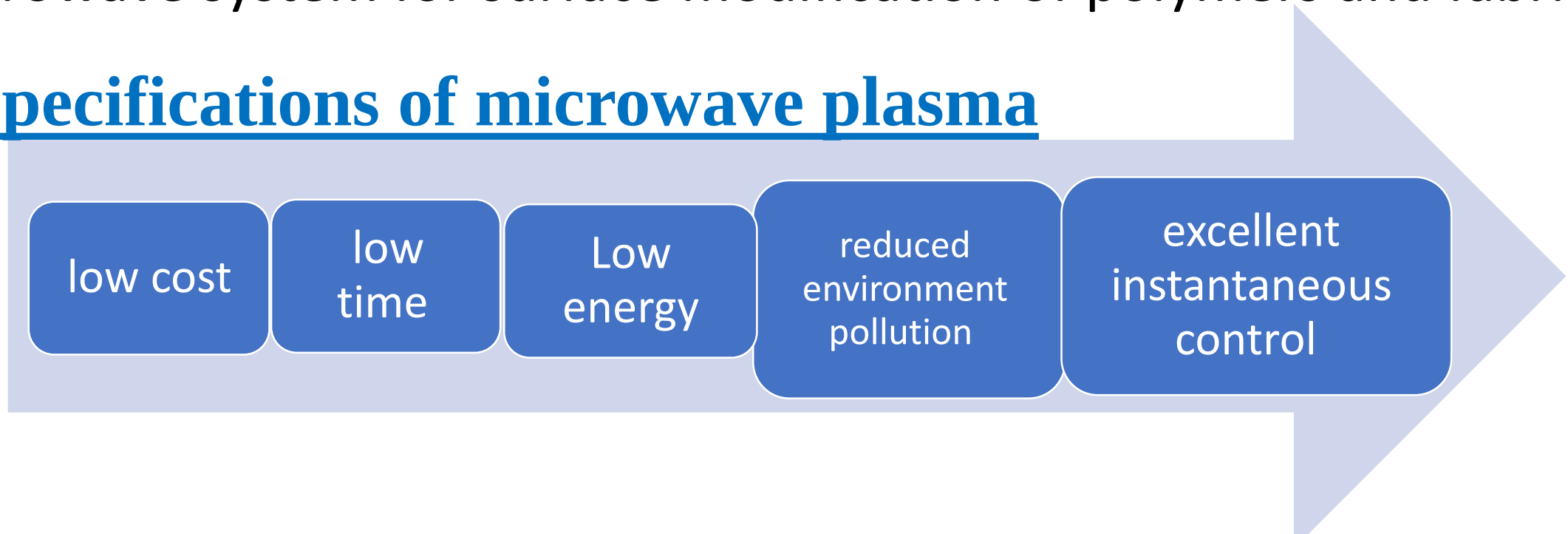
Specifications of microwave plasma

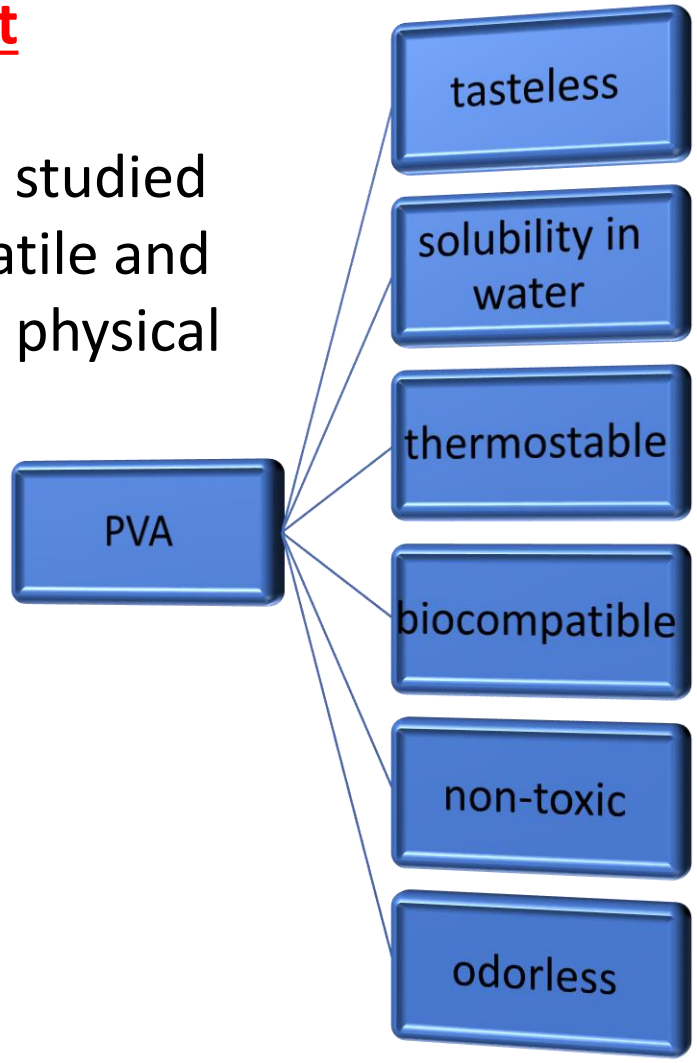


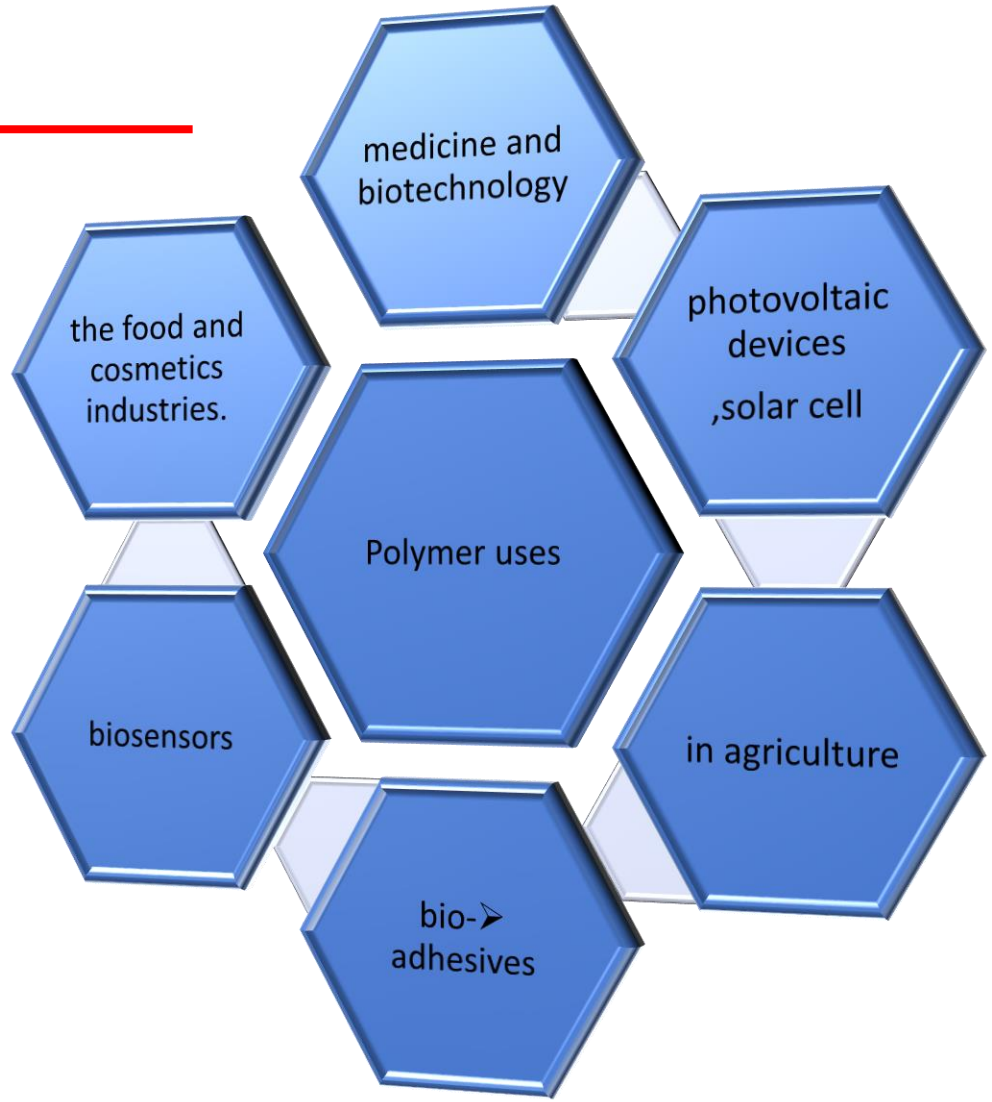
Introduction

Why should I care about polymers

the polymers have been studied widely due to their versatile and adjustable chemical and physical properties.

Special PVA





Introduction

The solar cell is one of the most effective utilization approaches for solar energy. At present, the research and development of solar cells mainly focus on:

(1) Mature silicon-based solar cells

(2) Thin-film solar cells.

(3) Emerging solar cells.

the diversified structures and functional modification also equip polymers with various **optical adsorption properties and variable electron mobility**, being used as the photo-active layer or buffer layer in OPV.

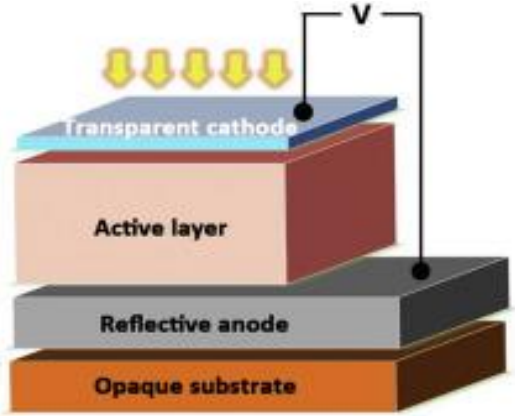
Polymer solar cells have many advantages

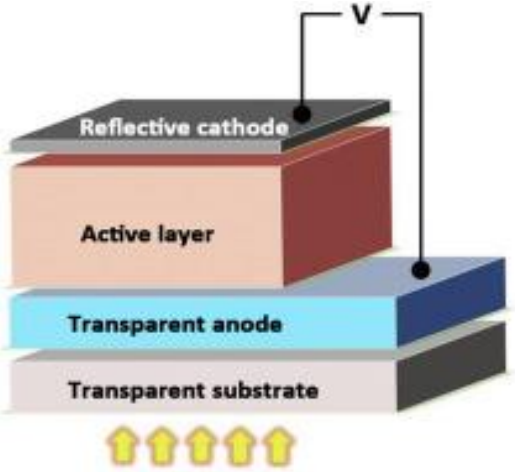
lightweight

flexibility

low material and manufacturing costs.

potential to achieve high performance.



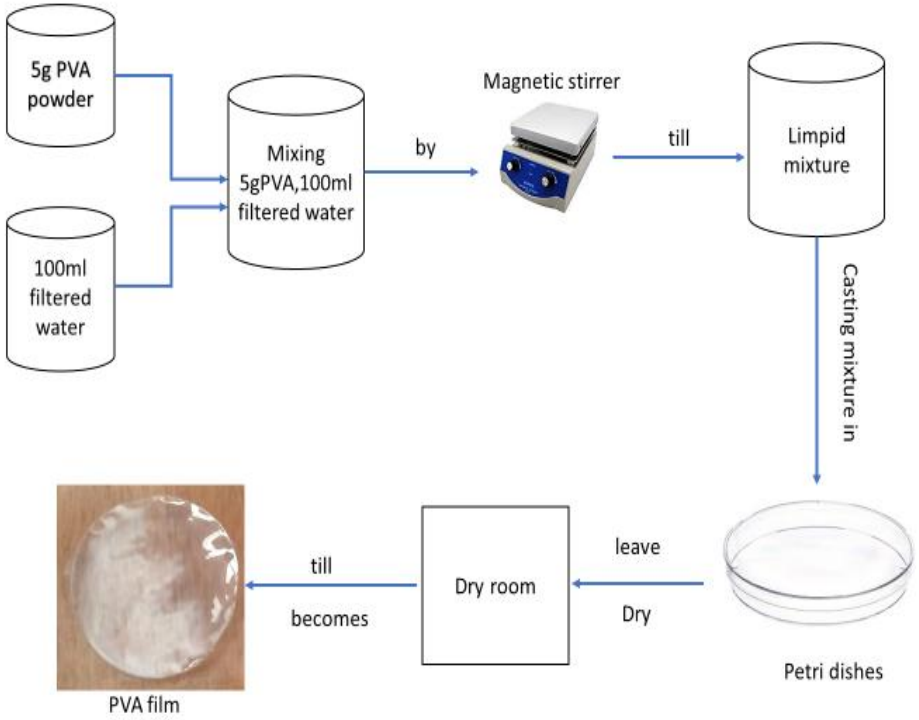


Motivations

Modification of the optical properties of a polyvinyl alcohol film for use in photovoltaic devices ,solar cell

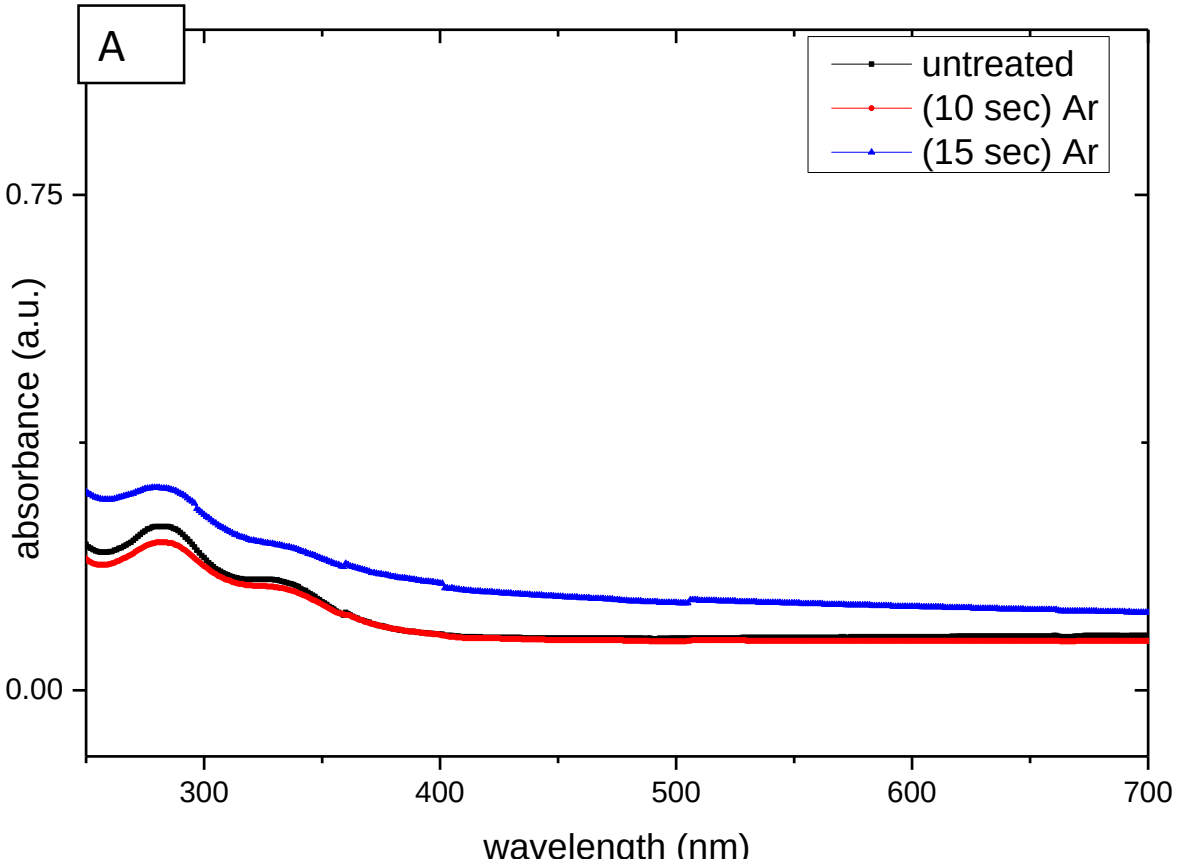
Experimental setup

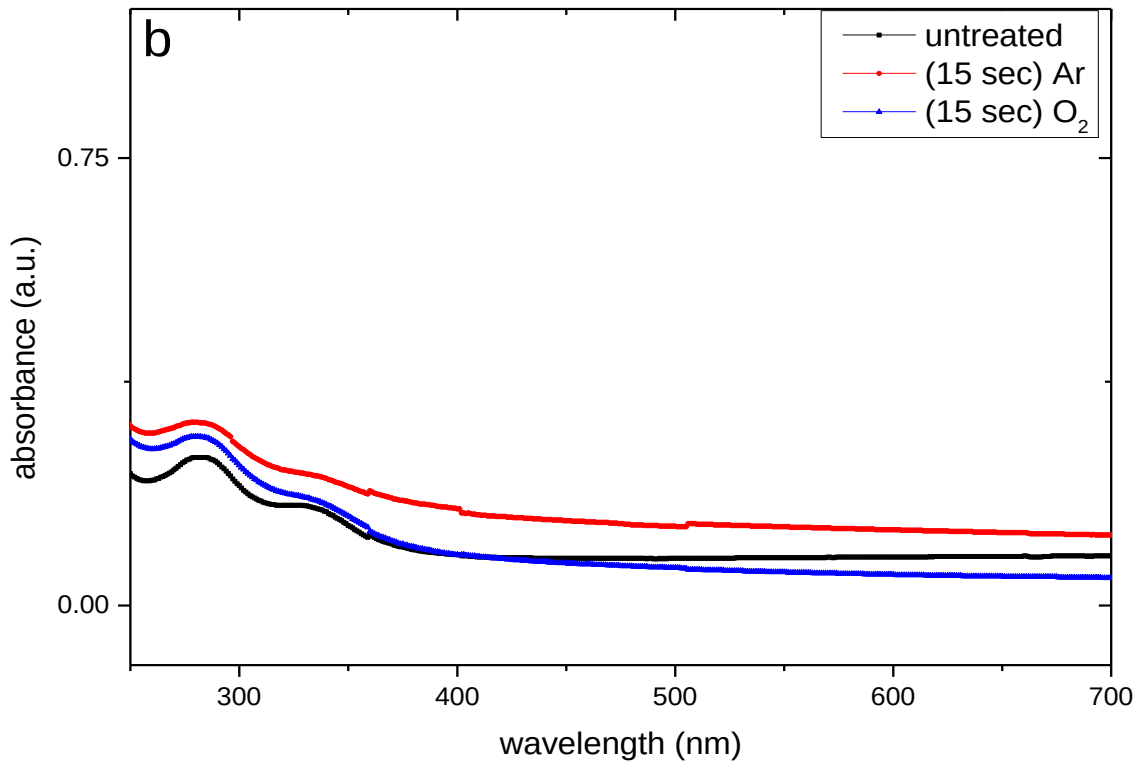
Microwave plasma system



Casting method

Results

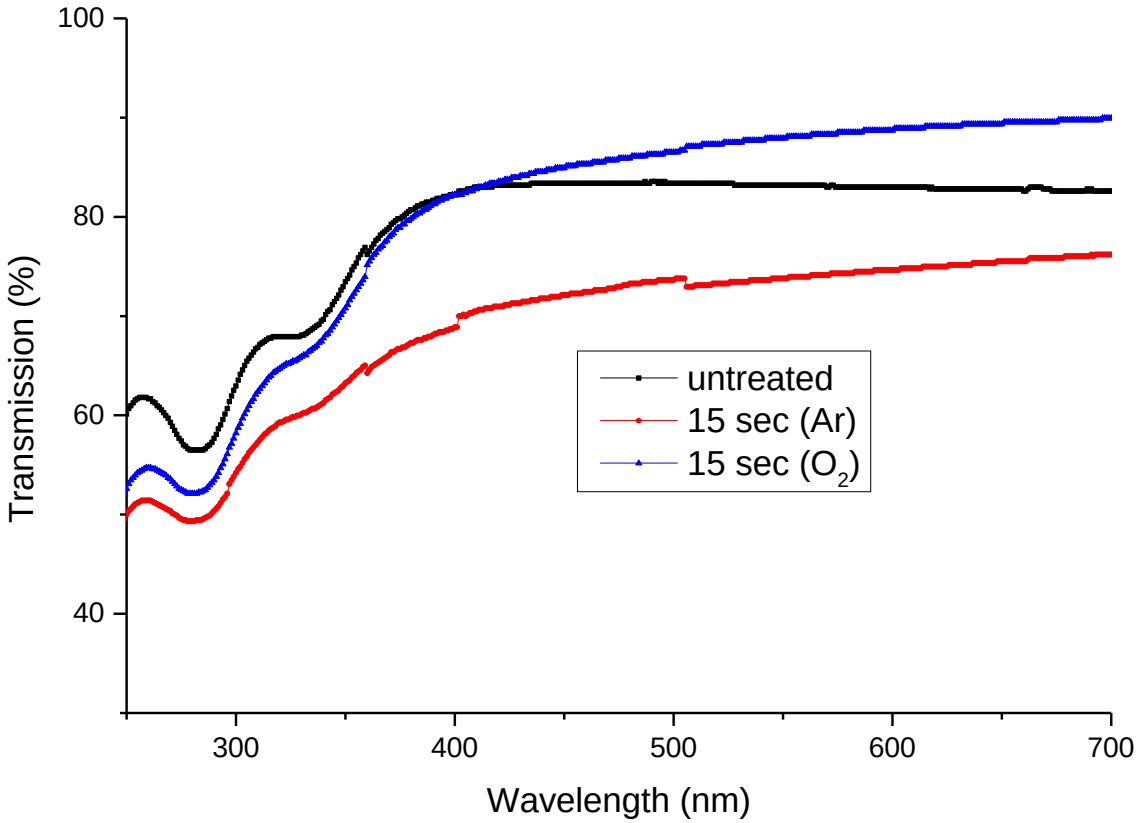


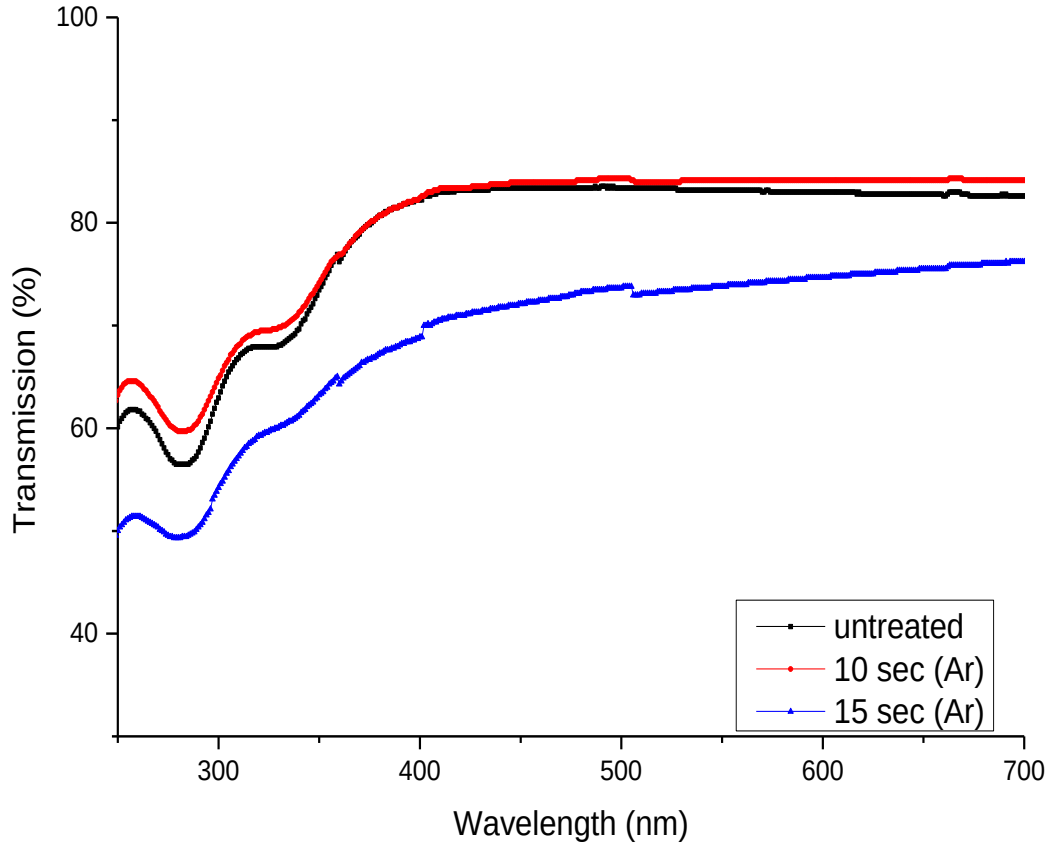


Absorbance versus wavelength of untreated and treated PVA

Results

- Transmission For Treated PVA Film By Oxygen In 15 Sec = 89 %
- Transmission For Untreated PVA Film = 82 %
- Transmission for treated PVA film by argon in 15 sec =75 %





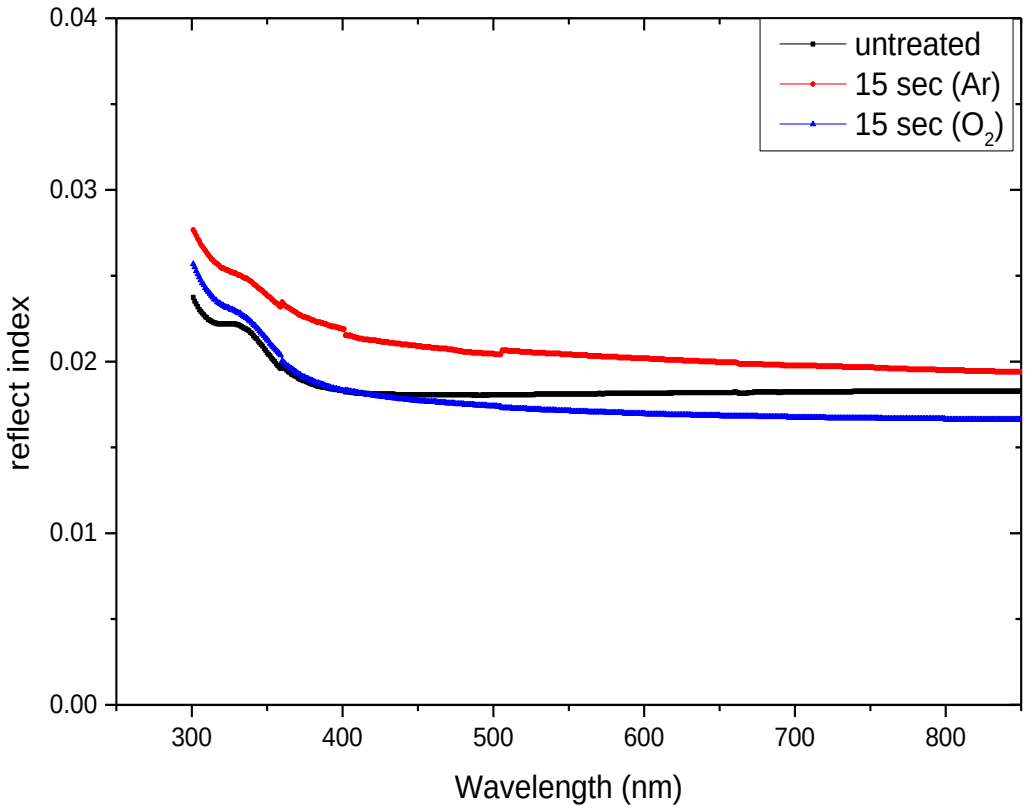
Transmission versus wavelength of untreated and treated PVA

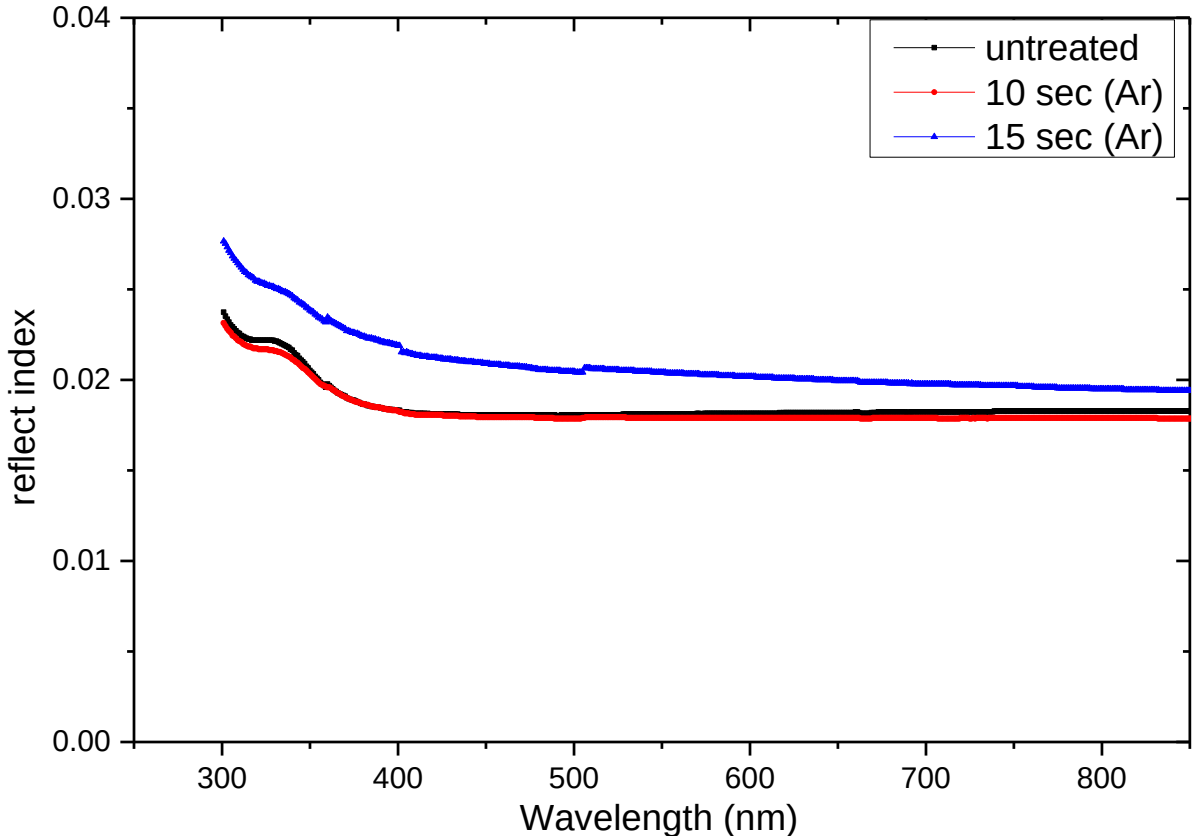
Results

Refractive Index (n) : is a measurement of how much a light beam bends as it travels from one medium to another. (T_s) denoted **percent transmittance**.

$$\mathbf{n} = \frac{1}{T_s} + \sqrt{\frac{1}{T_s - 1}}$$

$$T_s = 10^{(-A)} * 100$$



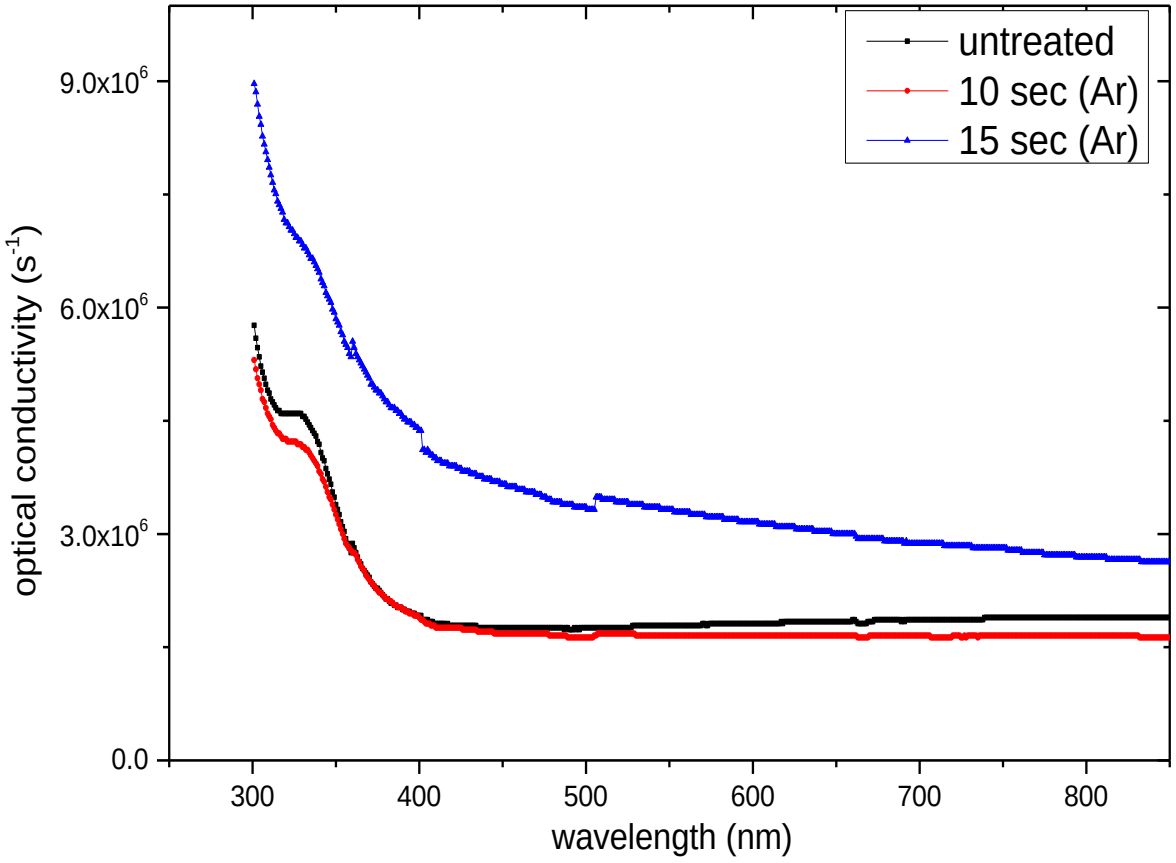


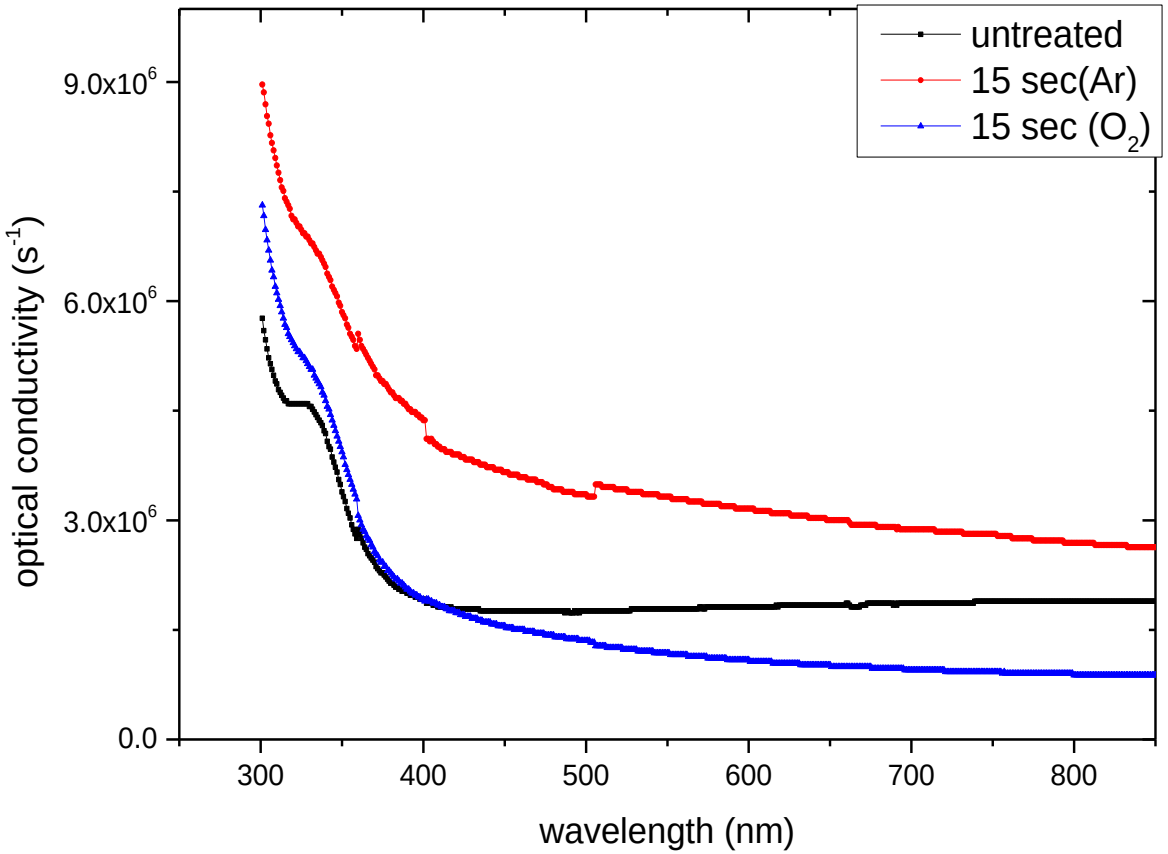
Results

The optical conductivity (σ)

$$\sigma = \frac{\alpha\, n\, c}{4\pi}$$

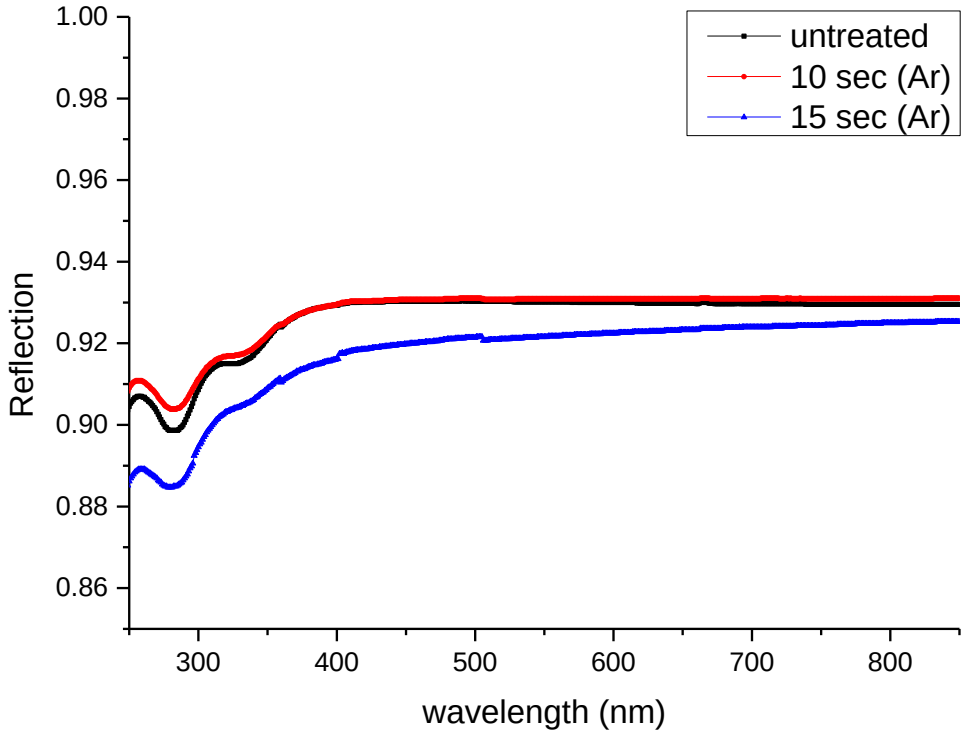
(c) is the **velocity of light in the vacuum**, **(α)** The **absorption coefficient** , **(n) Refractive Index**

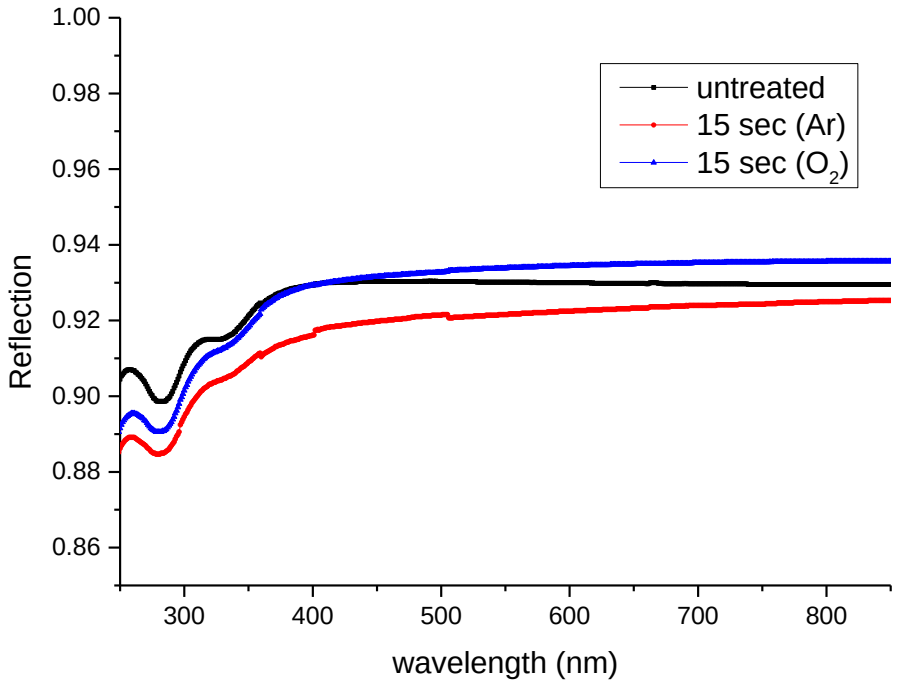




Reflection :

$$R = \left(\frac{n-1}{n+1}\right)^2$$



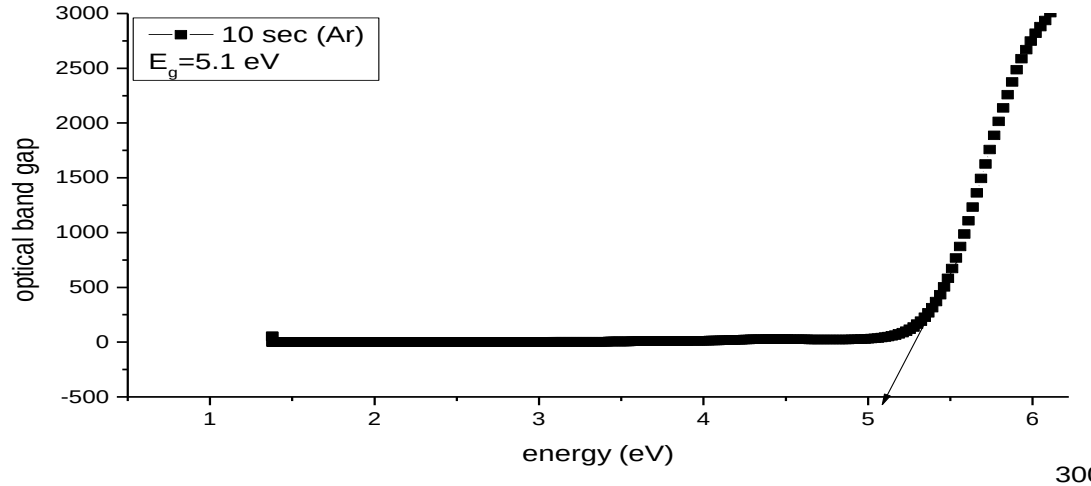


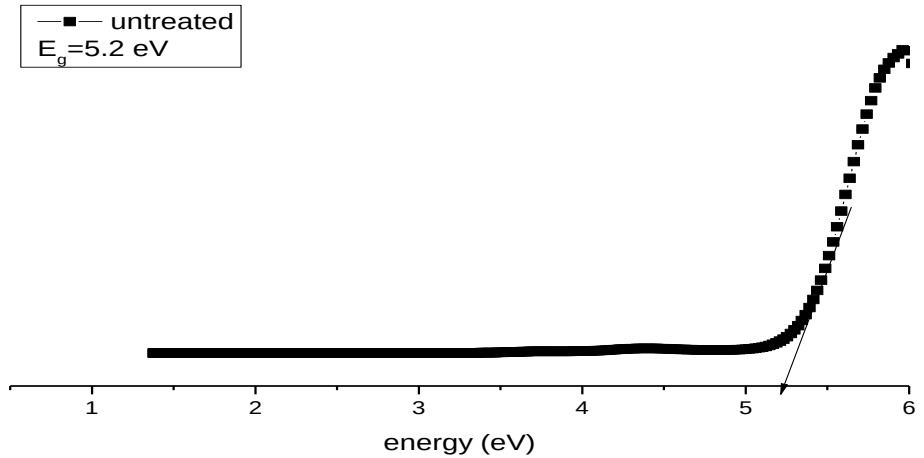
Reflection versus wavelength of untreated and treated PVA

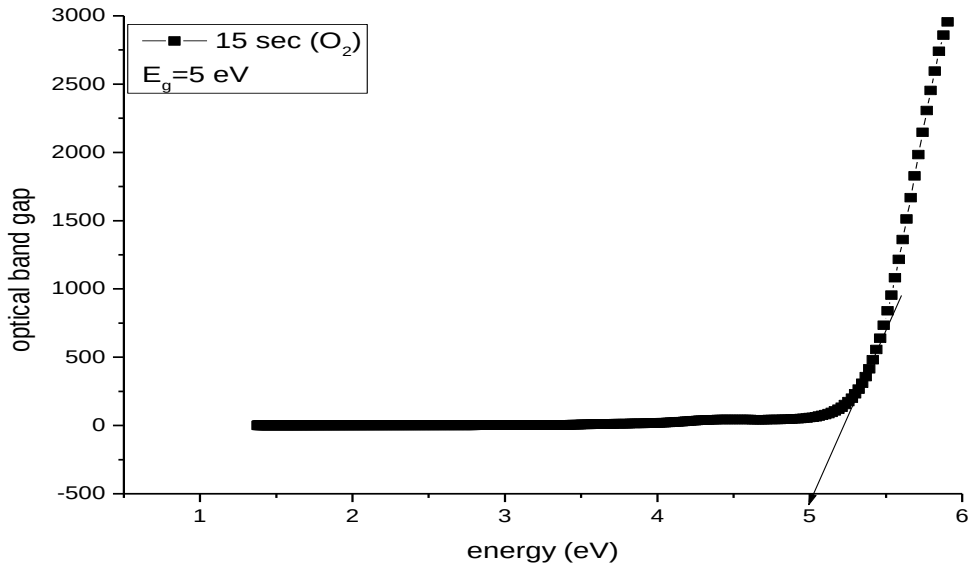
The energy gap it's found from Tauc relation: $\alpha h\upsilon = B(h\upsilon - E_g)^m$

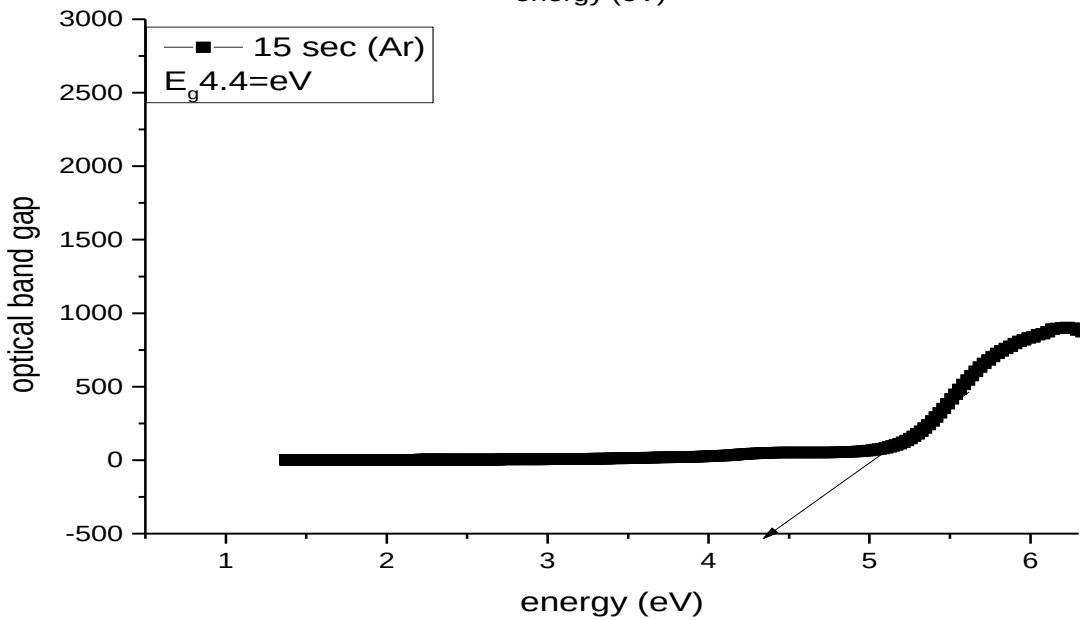
Where (hυ) represent photon energy, (B) is a parameter depends on transition probability, and m = 1/2 .

This reduction in values of the optical band gap corresponds to the formation of charge formation complexes inside the PVA matrix.



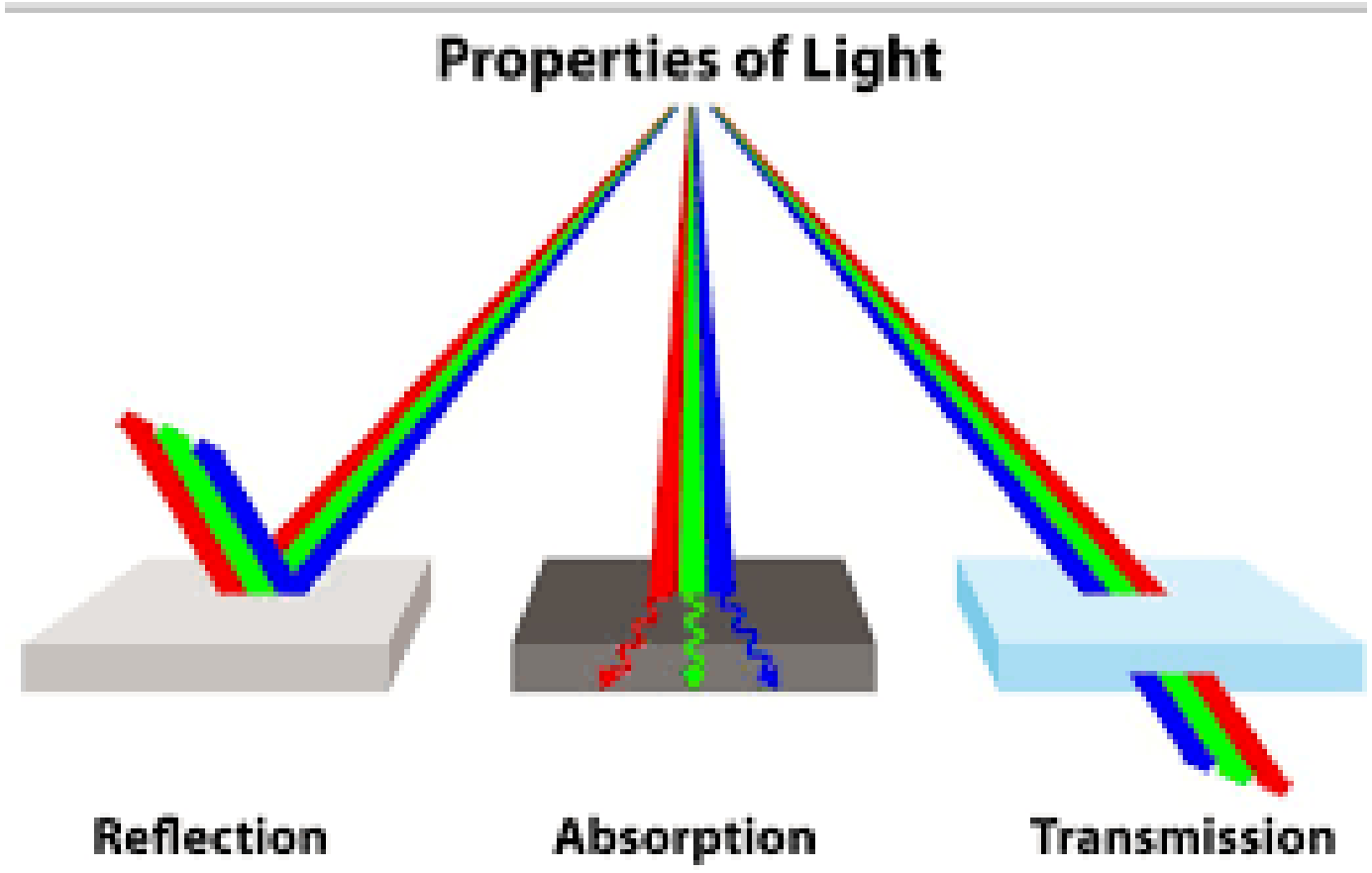






conclusion

- Prepare a PVA film and expose it to microwave plasma
- Prove the best condition (argon gas and 15 sec) for treated
- Increased **absorption** of PVA film after plasma treatment
- Reduce **the transmission** of the treated PVA film
- Increased **Refractive Index** of the treated PVA film
- increased **The optical conductivity** of the treated PVA film
- reduced **The energy gap** **from** 5.2 to 4.4 eV of the treated PVA film
- All this goals prove Possibility of using PVA film in solar cells



Reflection	Absorption	Transmission
Decrease by treated argon in 15 sec	Increase by treated argon in 15 sec	Decrease by treated argon in 15 sec

Thank you