Electrical and Optical Characterization of Graphite-ZnO Conductive Paint

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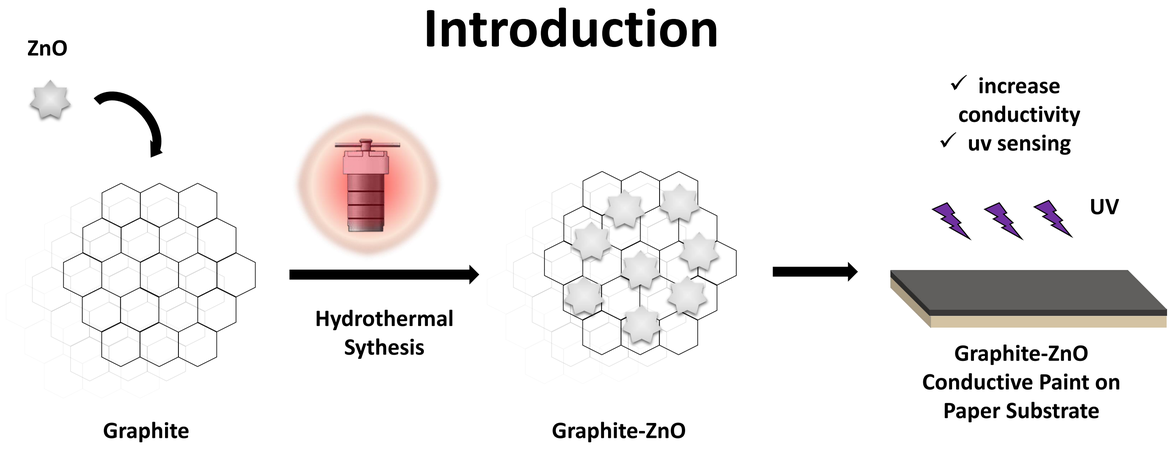
Abstract

In this work, graphite is used as the conductive material mixed with a well known UV active material zinc oxide to make a conductive paint. Aging deterioration of pure graphite film on its electrical properties wa found out that it does not degrade over the span of time significantly. There is an instability of the resistance of the graphite samples and thinner layers are more unstable and have greater resistance. The graphite-ZnO hybrid film for the application of UV sensing was also prepared via hydrothermal process of which 50% of the solution is the graphite and the other 50% is the ZnO. The IV characterization was done under UV-illumination and dark condition. Results reveal unusual behaviour of the samples comparing the graphite film and the graphite-ZnO hybrid film under UV-illumination, of which it shows that graphite film is more UV active than the graphite-ZnO hybrid film. Further analysis is needed in order to determine the reasons for this behavior.

Introduction



Related studies: **EPD of zinc oxide on graphite drawn on paper, graphite based conductive paint**

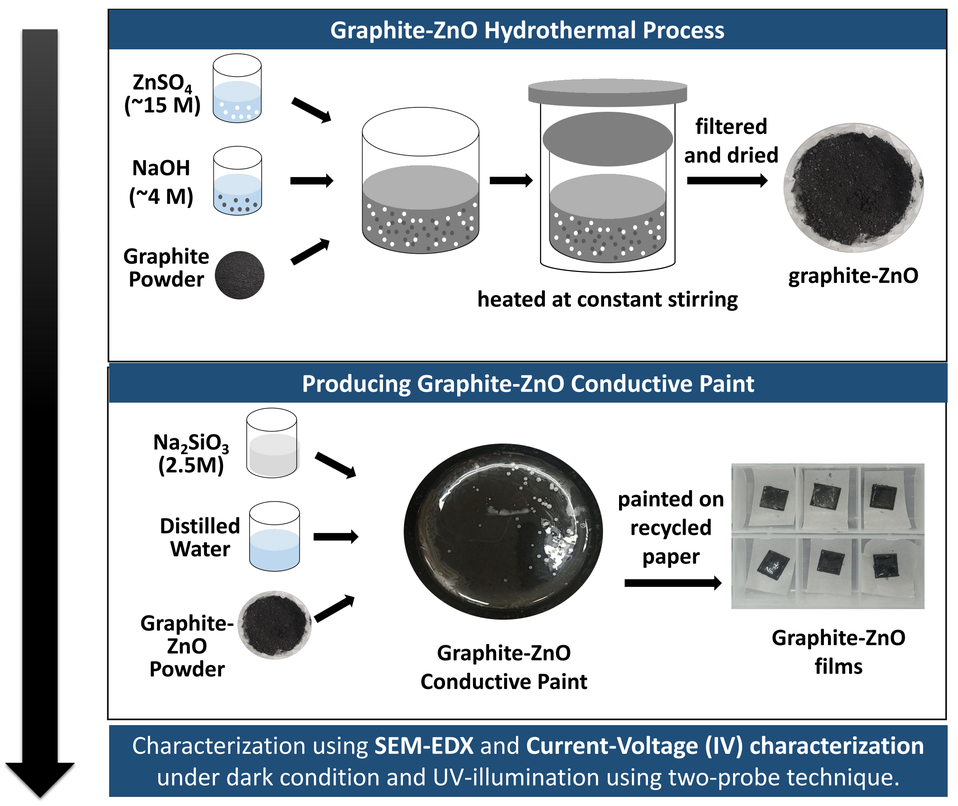
- ✓ Graphite powders: high conductivity with low surface area [1]
- ✓ Graphite-ZnO interface: electrical contact showed Ohmic behaviour by two-point probe method [2]
- ✓ Graphene adds conductivity to oxides [3]

❖ **Lesser studies have explored usage of transition metal oxide to increase concentration of holes in graphite, of which may increases the conductivity of the entire hybrid material.**

Present Study:

Synthesizing graphite-ZnO using hydrothermal process for conductive paint were investigated for aging deterioration, electrical resistivity, electrical and optical characterization, and thermal degradation.

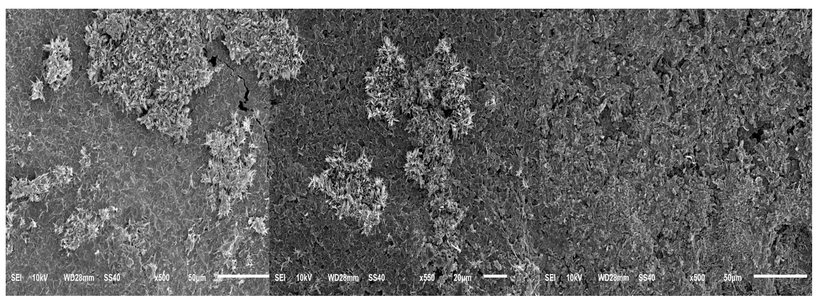
Methodology



Results & Discussion

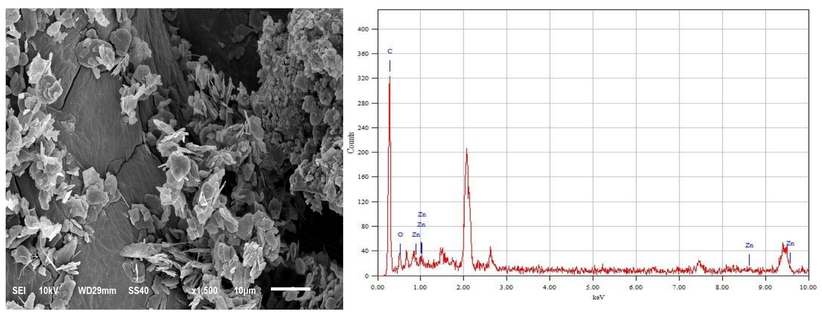
Scanning Electron Microscope - Energy Dispersive X-Ray Spectroscopy (SEM-EDX)

Graphite 1 Layer **Graphite 2 Layers** **Graphite 3 Layers**



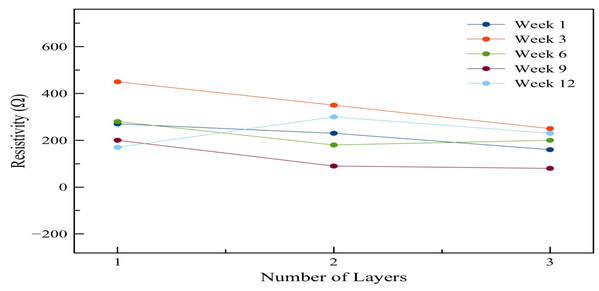
❖ **Thicker layers increases** the probability that enough paths of nanoparticles will form for sufficient **electrical conduction**.

Graphite-ZnO Powder



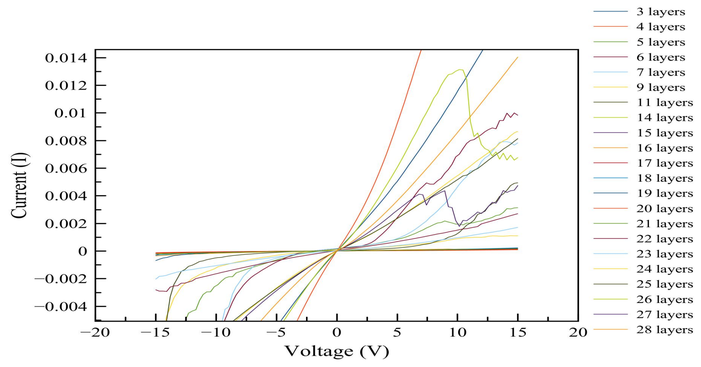
❖ Graphite- ZnO (50%-50%) synthesis showed least amount of ZnO

Aging Deterioration



❖ Resistivity of the pure graphite film examined every after three weeks for three months **does not degrade over the span of time** significantly.

Resistivity Optimization

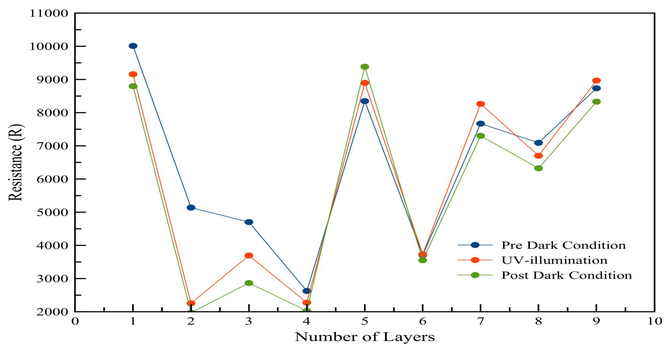


❖ Current decreases starting at 4 layers and relatively became stable at 14 layers onwards having a current very close to zero.

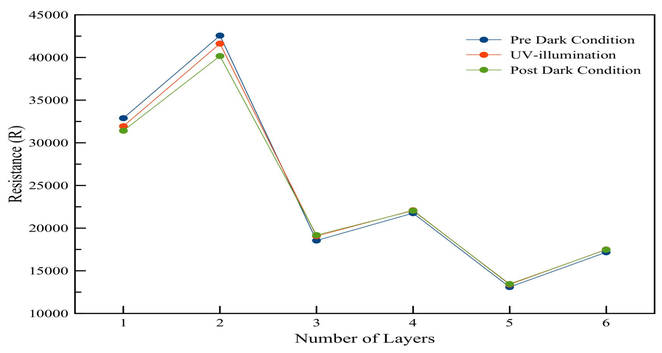
❖ 454.55 Ω optimum resistance at 4 layers

IV Characterization

IV plots of pure graphite film



IV plots of graphite-ZnO film



❖ IV characterization done under UV-illumination and dark condition of which graphite film is more UV active than the graphite-ZnO hybrid film.Further analysis is needed in order to determine the reasons for this behavior.

Conclusion

Graphite as a material for conductive paint, has a resistance to oxidation. Results have shown that it does not degrade over the span of time significantly. It has an optimal resistivity at 4 layers of coating having a resistance of 454.55 Ω. Incorporating ZnO using hydrothermal process for UV sensing application, IV characterization shows that it is less UV active than the pure graphite conductive film. To determine the reason for this behavior, further analysis is needed.

Acknowledgment:

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References:

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