

EXECUTIVE SUMMARY

This work contains a brief overview on the synthesis of conducting polymer composite- PANI coated silica gel with low concentration of PANI and the synthesis of PANI in the base form coated on silica gel with different concentrations. The dc conductivity of PANI coated silica gel with different ratio as well as varying aging conditions have been investigated. The dielectric permittivity, dielectric loss and ac conductivity with different ratios have been investigated. Dielectric properties are examined using Impedance Analyser. Silica gel /PANI in 2:1 ratio is found to be conducting. Composites are characterised by FTIR spectroscopy and XRD. Thermal analysis are carried out using TGA and DSC. Morphology is examined by SEM-EDAX. It is found that the composites are nonconducting in nature, so it will not act as an electrolyte in corrosion mechanism. Thus the composites resist corrosion by providing a non electrolytic surroundings. The composite synthesised can be used as filler in suitable matrix to improve its processibility and can be used as an anti corrosive agent. Different composites can be synthesised by changing the conjugated polymer. Composites play an important role in our daily life. This work focuses on the study of conductivity and anticorrosive properties of the conjugated polymer composites.

Brief objective of the project:

- ❖ *To synthesis conjugated polymers and To prepare conducting polymer composites based on these conjugated polymers.*
- ❖ *To study the conducting properties of these composites at different proportions and varying reaction conditions.*
- ❖ *To investigate the thermal characteristics and morphology of these composites.*

- ❖ *To determine the composite proportion with lowest polyaniline doping , which is conducting .*
- ❖ *To explore its anticorrosive property.*

In the first three to six months I had preliminary reading from internet, research journals and some books in the related topics. Also had some discussions with the experts in the field in CUSAT, Kalamassery, Kochi . The synthesis, characterisation and conductivity studies were done using the instruments and equipments at CUSAT, Kalamassery, Kochi. Silica hydrosol was prepared by sol-gel method from sodium silicate solution. Using this silica hydrosol three compositions of silica-PANI composites were synthesised (2:1, 1:1 and 1:2) by insitu polymerisation. The synthesis was done by oxidation method. Conductivity studies of composites and bare PANI were done using 4 probe conductivity instrument. Comparing the conductivity measurements composites were less conducting than PANI as expected. But the composition with less PANI content (2:1 proportion) was also found conducting. One of the objective of the studies is to carryout the conductivity studies of the composition with less PANI content at different reaction conditions. Silica hydrosol–PANI composite of 2:1 composition were synthesised with varying reaction conditions and studied its conductivity. It is named as A, B, C, D, E, F, G, and H. In A, B, F, G and H synthesised at normal conditions and the final washing was done with 1 N HCl. Drying of sample A was done at 85⁰ C. Sample H was also synthesised at similar conditions but aged for one and half years. Sample B was dried at 172⁰ C. Sample G was dried at 50⁰ C . Sample F was synthesised before aging the hydrosol and dried at 85⁰ C. Drying of sample C was done in vacuum at 76⁰ C. Sample D and E was synthesised at normal conditions and acetone was used for washing. In sample E final washing was done with HCl. The dc conductivities of the synthesised composites were taken using a four probe conductivity instrument. It was noticed

that the conductivity is varying with different reaction conditions. Structural ,Thermal and morphological analysis were done with the sample.

The second year of investigation started with the synthesis of polyaniline base and polyaniline base-silicagel composites.Different compositions of the composites are synthesized.The characterization have been done using IR spectroscopy,TGA and SEM analysis.The AC conductivity ,dielectric constant and dielectric loss are investigated. From the dielectric studies it is found that the emaraldin base show a decrease in permittivity at higher frequency range.With the incorporation of silica gel,the permittivity increases slightly on increasing the frequency,then shows a gradual decrease at higher frequency range.As the concentration of silica gel increases the trends become similar to that of EB.The dielectric loss increases gradually ,then becomes constant on increasing the frequency in the case of EB.When composite is formed with silica gel there is a steep increase in dielectric loss then a gradual decrease and finally a sudden decrease on increasing the frequency.As the concentration of silica gel increases the graph shows the similar nature as that of EB.The studies shows that the silica gel/PANIbase composites are nonconducting.So it will act as a nonelectrolyte when come in contact with a metal.These composites can be used to protect metals from corrosion as they resist the transfer of ions during electrolytic corrosion.

The composite synthesised can be used as filler in suitable matrix to improve its processibility.Different composites can be synthesised by changing the conjugated polymer. Composites play an important role in our daily life. This work focuses on the study of conductivity and anticorrosive properties of the conjugated polymer composites.



