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Development of conducting organic polymer film by R. F. plasma polymerization

Mukesh Nigam
emkayn@gmail.com
Lakshmi Narain College of Professional Studies, Gwalior, Madhya Pradesh

ABSTRACT

Electrodeless R.F. capacitive coupling is used to make plasma polymer. The thickness of the film measured to be 8.0 µm. The film is made conducting by doping with Iodine. The resistivity measured with Vander Pauw's Method and it was found to be 1.7 KΩ cm. Hopping conduction mechanisms found to be the probable mechanism of charge transport in the obtained polymer film.

Keywords— *R.F. Power, Polymer, Capacitively coupled, Doping, Poly Acetylene*

1. INTRODUCTION

Polymers are generally obtained by chemical methods, which generally provide thick films. Thin films of polymers can be easily obtained by the plasma polymerization process. Plasma provides a new way of transferring energy to the reacting molecules. In this process, energy is directly transferred to the reacting molecule by means of the collision. The formation of the polymer film in a low-pressure electrical discharge is known as plasma polymerization[1]. The plasma polymerized polymer films are found to possess highly cross-linked structures and are well suited for electrical insulating materials. On account of rapidly increasing industrial use, the study of electrical conduction through polymer has also gained much importance. In the present article, we report the preparation of polymer films of polyacetylene by capacitive coupled R.F. glow discharge system. In order to synthesize polymer, R.F. plasma reactor was designed and fabricated in the laboratory. The films so prepared were doped with iodine which served as an acceptor in the present case. The polymer is doped with Iodine exhibits an increase in electrical conductivity

2. EXPERIMENTAL DETAIL

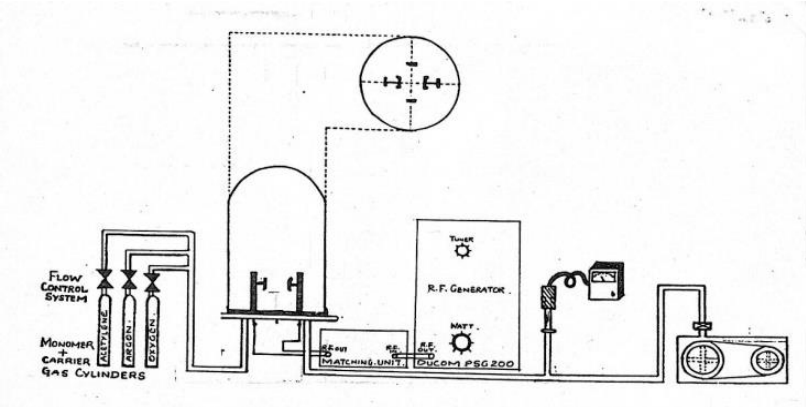

Fig.1: Schematic diagram of Experimental Set-Up

Polymerization was performed in a capacitive coupled glow discharge system. The Acetylene gas of industrial grade was then allowed to pass in an evacuated chamber on from am R. F. power oscillator DUCOM PSG 200. The complete set-up is as shown in figure 1. Golden yellow color films were obtained on passing acetylene in the reactor. The films so obtained were then doped with iodine. The thickness of the film was measured by Multiple-Beam Interferometer method. The conductivity of the doped film is measured with the help of Vander Pauw's method[2]. This is a standard method for measurement of resistivity of semiconducting sample of any arbitrary geometry. Four electrical contacts were made with the help of silver paints on the polymer film. The constant current supplied at two contacts by Keithley constant current model 220 and voltage developed was measured at the other

contacts. The current was observed using Keithey Multimeter model 196. The resistance $R_{12,34}$ was then calculated from measured data. The current contact terminals were interchanged later with voltage terminals and corresponding resistance $R_{23,41}$ was also measured. The resistivity was calculated using standard Vander Paws' relation

$$\rho = \frac{\pi}{\ln 2} t \frac{R_{12,34} - R_{23,41}}{2} f \qquad f = f\left(\frac{R_{12,34}}{R_{23,41}}\right)$$

3. RESULT

The thickness of the film measured to be of the order of 8.0 µm. The resistivity of the doped forum to be 1.7 K Ω cm. The results so obtained were found to be in fairly agreement to the result reported[3] earlier using chemical methods. A sudden increase in current at higher fields is observed in I-V characteristics which indicated Pool-Frenkel effect.

4. CONCLUSION

The polymer of polyacetylene is found moderately conducting when doped with Iodine. The magnitude of the conductivity also suggests transport of the charge by self-trapped charge carried.[4]. Consequently hoping transport of self-trapped species is found to be probable conduction mechanism in plasma polymerized polyacetylene film.

5. REFERENCES

[1] Reference 1 Boeing H.V.., "Plasna Sci. & Tech." Corwell Uni.Press in 1982.
[2] Reference 2 Vander Pauw, L.J. Phillips Res.Rept. 13, 1, 1988.
[3] Reference 3 Maiti S., Rehman S, Kudu S, " Bulletin of ERlectro-Chem" p.p. 556, 8 (11) 1992.
[4] Reference 4 Lecler M, Guay J and Dao L.H., Macromolecules, 22,649, 1989.

