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Sem Studies of Unirradiated And Irradiated Sodium Polystyrenesulfonate

N Maramu[a] and M Papi Reddy[b]

[a]Department of Physics, Kakatiya Institute of Technology & Science, Warangal-506015,T.S

[b]Research Scholar, Dravidian University, Kuppam, Chittoor district, A.P.

Email ID: nmaram3@yahoo.com

Abstract

In order to study radiation effects in ammonium salt of polystyrenesulfonate, it is appropriate to know about radiation effects in other salts of polystyrene sulfonate. An attempt has been made in this regard by using Scanning electron microscope(SEM) spectroscopy. On irradiation a change in the molecular structure is observed in SEM images reasons for these changes are explained based on chemical changes induced by gamma irradiation.

Key words: Polystyrenesulfonate, Scanning electron microscope(SEM), gamma irradiation.

Introduction

Sanjeevarao et al (1) has reported TSL studies of unirradiated and irradiated polystyrene sulfonate. These authors have observed a TSL glow peaks around 85^{o}C, which is considered to be associated with glass transition temperature of polymer. Since Tg of polystyrene is around 80 ^{0}C, the Tg of NaPSS is thought to be around the same temperature . On irradiation the glow shifted to low temperate due to cleavage of side chain.

Later ESR studies of gamma irradiated Sodium polystyrene sulfonate (NaPSS) have been reviewed by Thimma Reddy (2). These authors have observed an ESR singlet spectrum. The spectrum is thought to be associated to be due to the free radicals formed in side chain of polymer.Based on radiation dose depending of free radicals generated in NaPSS, Prasad et al (3) have reported that

NaPSS is suitable for dosimetric applications.Rajendra Prasad et al (4) reported TSL spectra of unirradiated and irradiated monovalent and divalent salts of PSS. These authors have evaluated trap parameters of glow peaks under different conditions. Gamma irradiation of polymers is an important way to later the chemical structure causing a change in physical properties to improve their applications.

In this context the authors have exposed NH_4 PSS to gamma irradiation and investigated the changes in thermal properties. To characterize the surface morphology of irradiated and non-radiatedNH_4PSS SEM micrographs have been taken under different conditions.

Experimental work

NH_4PSS in the form of films procured from Pressure chemicals, USA is used in the present studies. Gamma irradiation of the polymer is performed in cobalt 60 (Co_{60}) gamma source which has at a rate of 15KGy (0.15 M.rad/hr) at room temperature. SEM micrographs of un irradiated and irradiated NaPSS have been recorded on Zeiss electron microscope for the powder samples by placing the sample on the cylindrical stub.

Results & Discussions

SEM Studies: Microscopic surface of the polymer has been examined by taking SEM micrographs of the polymer under different conditions as shown in Fig 1, Fig 2 , and Fig 3. Unirradiated PSS bear smooth surface, while surface of irradiated PSS possess rough surface. In addition bores and cracks are visible on the surface of irradiated PSS, indicating the role of gamma irradiation. It is observed that the cracks and bores and their size gradually increase with dose of irradiation. It is reported that on irradiation cleavage of chemical groups occur and destruction of molecular structure occur. These changes have been confirmed by recording the FTIR spectra by the authors previously. Further ESR studies at different temperatures and radiation doses also confirm the formation of free radicals. The studies also suggest that the polymer can be used for dosimetric aspects.

The SEM studies also confirm the same result that due to the damage of molecular structure and formation of free radical the morphology the polymer will also be influenced as observed in the present studies.

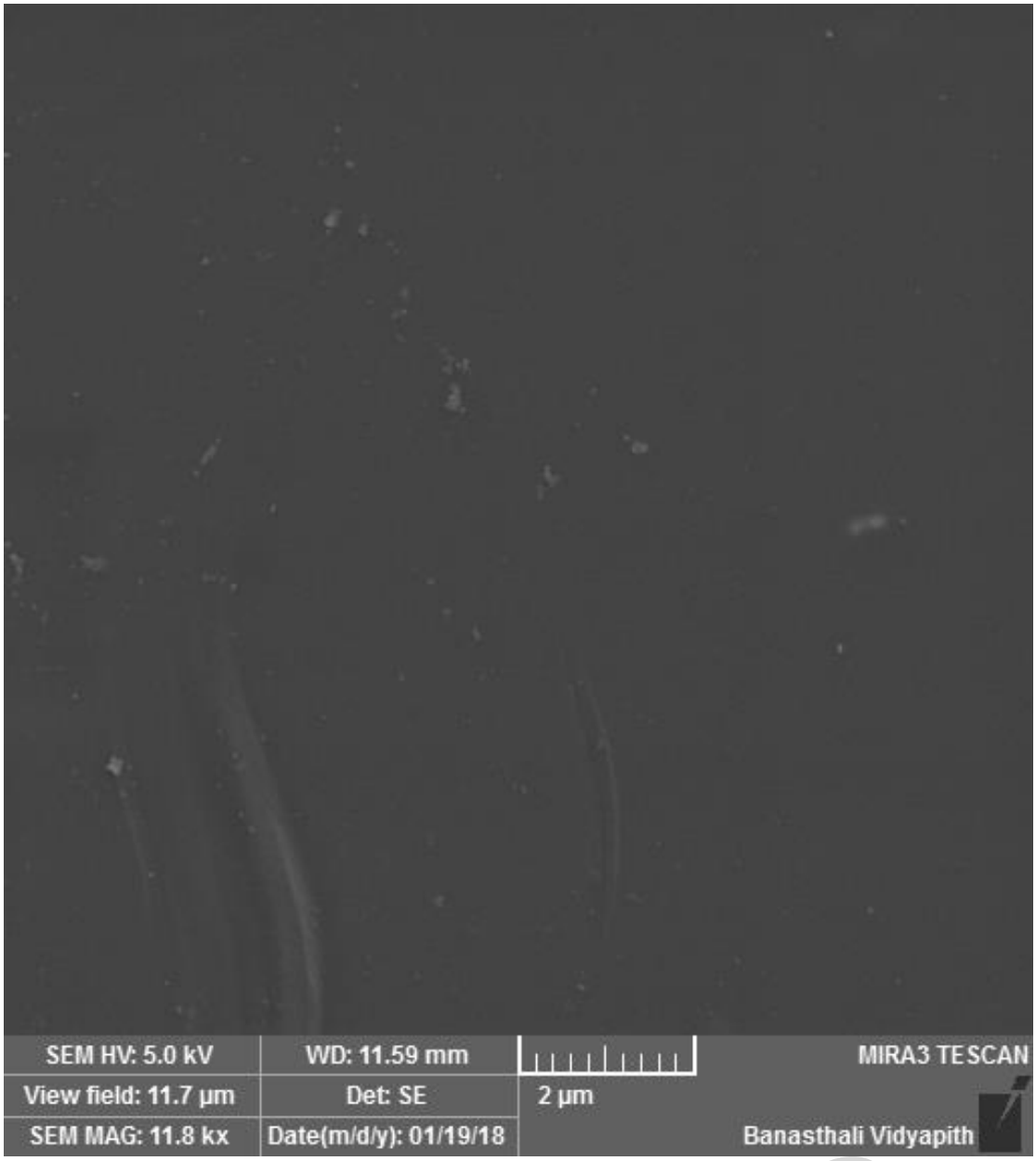

Fig 3: SEM micrograph of PSS irradiated to high radiation dose

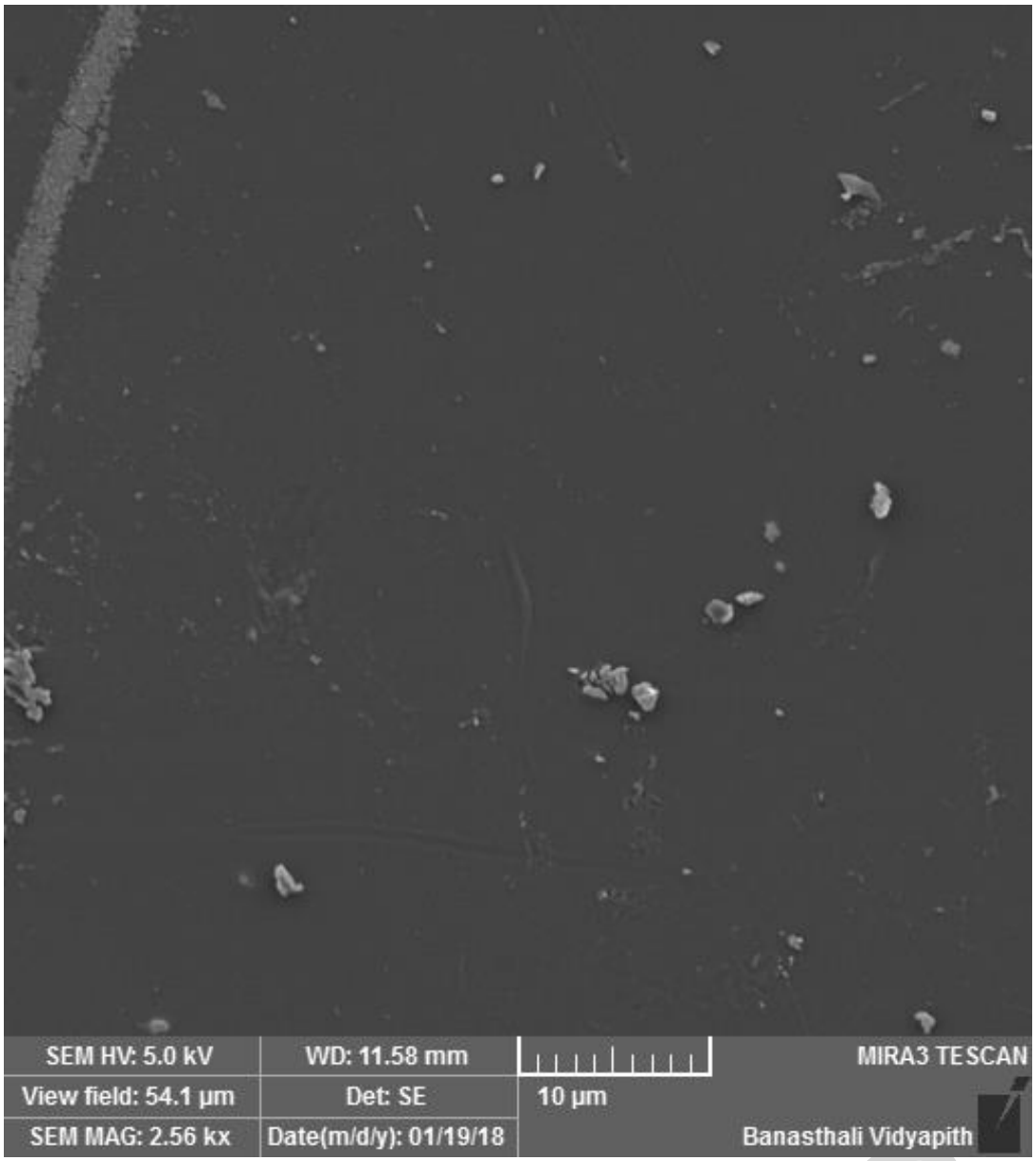

Fig 2: SEM micrograph of PSS irradiated to low radiation dose

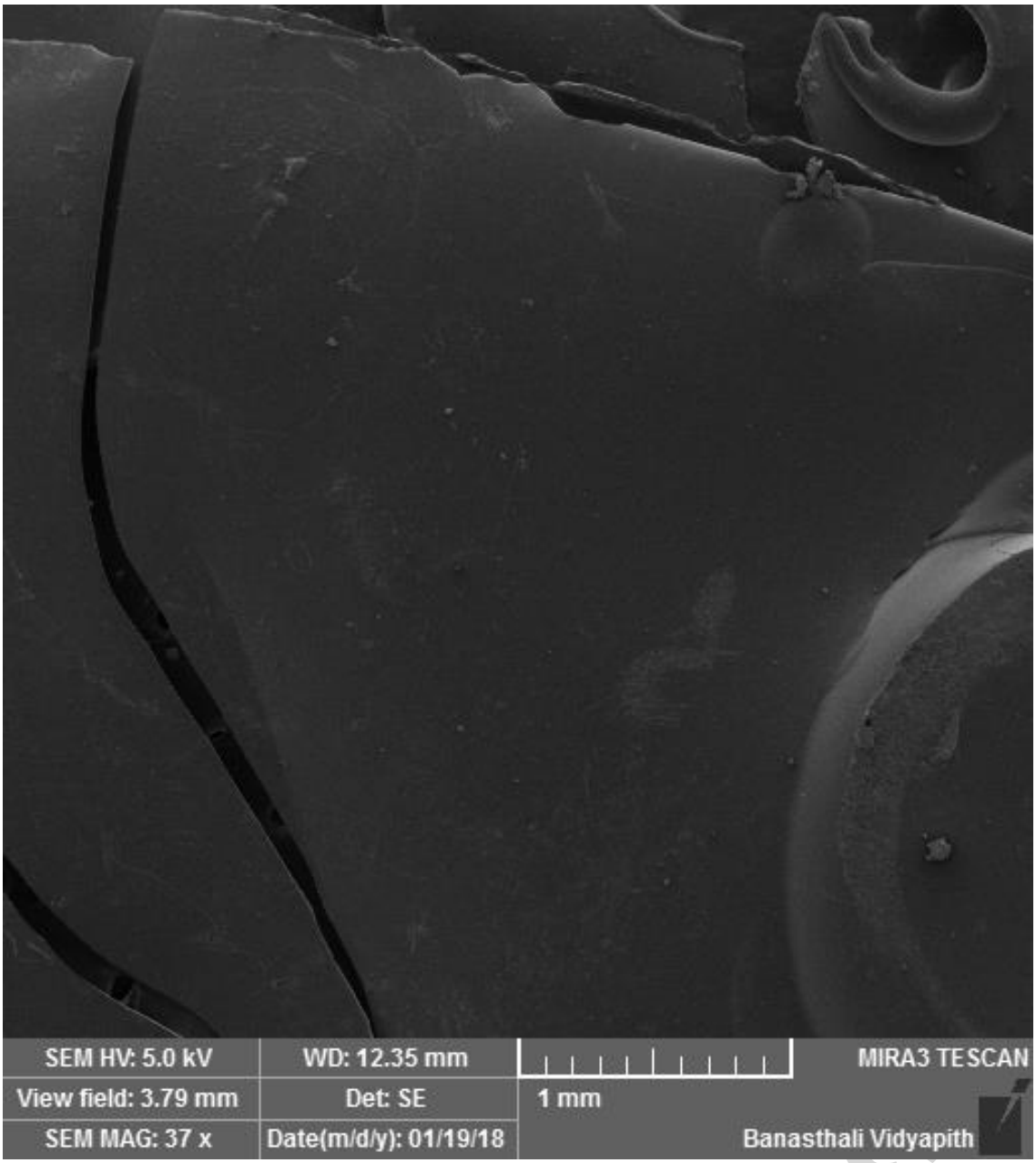

Fig 1: SEM micrograph of unirradiated PSS

Conclusion

Gamma irradiation of sodium polystyrene sulfonate cause cleavage of chemical groups effecting its molecular structure. Due to irradiation bores and cracks appear on the surface of polymer whose size increase with dose of irradiation.

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