Preface

Molecular transport of organic solvents through polymeric materials has been a subject of both technological and fundamental interest for a variety of applications such as food packaging, controlled drug release, reverse osmosis, electrodialysis and mixture separation. A deep knowledge of the behaviour of different polymeric systems in liquid environment is highly essential for developing suitable products for all these applications. The investigation of the transport characteristics of different macromolecular systems such as polymer blends, composites and interpenetrating networks is thus an extremely fascinating field of research.

Styrene butadiene rubber (SBR) is a general purpose multitalented synthetic rubber having high filler loading capacity, good flex resistance, crack-initial resistance and abrasion resistance, which make it useful for several engineering and industrial applications. However, it has poor ageing characteristics. In order to minimize the oxidative degradation of SBR during service at high temperature, it is advisable to blend it with a saturated or lesser unsaturated polymer. Poly(ethylene- co- vinyl acetate) (EVA), a semi crystalline polymer, may be considered as a good partner for this purpose as it offers excellent ageing resistance, weather resistance, toughness, chemical resistance and processability. A blend of amorphous SBR and semi-crystalline EVA can give many desirable transport characteristics and mechanical properties. The goal of the present work is to evaluate the transport features of SBR/EVA blends, using different organic liquids, with special reference to the effects of blend ratio, crosslinking systems, fillers and a compatibilizer. The
background, objectives and the results of the investigation have been presented in
nine chapters in this thesis.

Chapter 1 gives an overview of the fundamentals of transport phenomena, factors
affecting the transport process in polymeric systems, characteristics of polymer
blends and the transport features of blend systems. It also presents an account of the
earlier reports on the transport features of polymeric systems, especially of polymer
blends, and the scope of the present investigation. The details of the materials used
and experimental techniques adopted are given in Chapter 2.

Chapter 3 summarises the transport characteristics of SBR/EVA blends, with
aliphatic hydrocarbons as penetrants. The sorption and diffusion processes have
been examined in terms of blend ratio and penetrant size. The results have been
complemented with the observations on the morphology of the blends by using
scanning electron microscopy (SEM).

Chapter 4 describes the results of the investigation on the interaction of SBR/EVA
blends with chlorinated hydrocarbons. This chapter also deals with the stress-strain
properties of the blends under dry, swollen and deswollen conditions.

The effect of a physical compatibilizer viz. dichlorocarbene modified styrene
butadiene rubber (DCSBR) on the transport characteristics of the blend systems has
been described in Chapter 5. Special attention has been given to the effect of
compatibilizer loading. The mechanical properties and the surface morphology of
the blends have also been given to support the observations on the transport process.
The barrier properties of SBR/EVA blends reinforced with three different carbon black fillers viz. semi-reinforcing furnace (SRF), high-abrasion furnace (HAF) and intermediate super abrasion furnace (ISAF) have been described in Chapter 6. The extent of reinforcement of fillers in the matrix, which significantly controls the transport phenomenon, has been discussed in terms of Kraus equation.

A comparison between a black filler (intermediate super abrasion furnace, ISAF) and a white filler (silica; Ultrasil VN3), of the same loading, on the transport features of SBR/EVA blends has been discussed in Chapter 7. The results have been explained in terms of the differences in the interaction between the blend components and the filler particles.

A study of the transport behaviour through SBR/EVA filled with a bio-degradable filler viz. chitin has been presented in Chapter 8. A comparison of the sorption behaviour of the samples, with and without chitin, has been done using polar and non-polar solvents viz. de-ionized water, pentane, hexane, and kerosene.

The major findings of the present investigation and the scope of future work have been given in Chapter 9.