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Flexible Sulfur film from inverse vulcanization technique

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Abstract: Flexible, freestanding polysulfide films with high sulfur content (50 to 90 % sulfur) were prepared via inverse vulcanization technique by reacting sulfur and diallyl disulfide; a naturally occurring diene. The prepared films are partially transparent depending on the amount of sulfur loading. SEM images showed a smooth and uniform surface of the film. XRD and DSC results confirmed the conversion of crystalline sulfur into an amorphous co-polymer. Low Young modulus and high tensile extension at break confirmed the flexible and elastic nature of the films. The flexibility of the films could be due to the presence of freely rotating low aliphatic carbon chains, which leads to low glass transition temperature ($T_g = -13^\circ\text{C}$ to -4°C) of these films.

Keywords: Sulfur, Inverse vulcanization, Film, Flexible, Thermo-mechanical

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1. Introduction

Sustainable chemical processes from naturally occurring and industrial waste materials have attracted increased attention due to the growing environmental awareness. Sulfur being the thirteenth most abundant element in the earth's crust is mined in its elemental form and also produced as a by-product of petroleum refining, currently around 70 million ton of sulfur is produced annually [1,2]. A large amount of sulfur is left as surplus due to lack of utilization and wide scale applications beyond sulfuric acid, which accounts for more than 85% of sulfur product.

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