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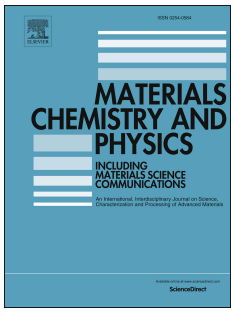


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# Synthesis, characterization, and evaluation of the hydrophobic, dielectric properties of phenols functionalized nylon 6 polymers by Zinc acetate catalyst using Mannich reaction

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## Abstract

Synthesis of phenols functionalized nylon 6 by zinc acetate catalyst using the Mannich reaction to enhance the hydrophobic and dielectric properties was described in this paper. The structure of the phenol functionalized nylon 6 was established by FT-IR, NMR, MALDI-TOF, GPC, and DSC-TGA. The functionalized polymer has a decomposition temperature of about 400°C and exhibits good thermal stability. The water contact angle measurement shows the functionalized polymer has hydrophobic nature with a contact angle of above 90° and the preliminary dielectric measurement shows the functionalized polymer has relatively low dielectric constant and loss. This thermally stable and hydrophobic polymer is potential materials for the electronic device application.

**Keywords:** Polyamide-*6* (Nylon 6), Phenols, Mannich reaction, Water contact angle measurement

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## 1. INTRODUCTION

Organic dielectric constant (*k)* materials have been known for many years and are important parts of electrical/electronic devices. In the development of new generation communication technology low dielectric materials are required. To accompolish this, a variety of polymers like polyimide, polybenzoxazine, PEEK and cyanate ester have been prepared and used as a low dielectric material with low moisture absorption property required in the application of designing microelectronic device. Polyamides are much sought after material because of their excellent mechanical performance, chemical resistance, and high melting temperature [1]. These materials exhibit good thermal stability over a wide range of temperature ranging from sub-zero to 150$^{o}$C. Due to these underlying factors, polyamides are versatile plastic material especially, the polyamide (PA-*6* & PA-*66*) [2]. Nylon 6 too have low dielectric constant, however, their tendency to absorb moisture has limited their application [3] in electronic device. Nylon 6 contains highly polar amide groups, and several modifications were attempted to bring down their moisture absorption [4-7] which include involving blending and surface modification [8-11]. However, till date efforts to decrease the moisture content to the desired level have not been completely successful.

There is always a constant demand for the modification/ functionalization of nylon 6[12], in order to achieve various desirable properties, including superior mechanical performance, high melting temperatures, and good chemical resistance [13]. Variously blended crystalline and amorphous polymers containing nylon 6 have been investigated to understand their glass transition temperatures ($T_g$) [14, 15] and other blended properties [16]. In general, nylon 6 blends with polymeric phenol-containing molecules (*e.g.*, sulfonated phenol-formaldehyde resin) form strong complexes through hydrogen bonding [17]. In this regard, several studies on the functionalization/modification of nylon 6 surfaces were carried out [18-21]. Despite, various desirable properties of nylon 6, it was understood that the presence of amide group is responsible for moisture uptake causing a reduction in insulation ability,