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Report on biphenyl-based synthetic polymers

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Abstract : Biphenyl and its suitably substituted analogues have shown their remarkable recognition in synthesizing various polymeric compounds of commercial importance. Some of them may be discussed as fibres, adhesive films, wire containing, optical and dental additives, primers, expoxy resins. Etc.

(Keywords: Biphenyls, fibres, adhesive films, rubbers adhesives, electrographic photoreceptors, dental and optica materials epoxy resins, etc.)

Introduction

Biphenyl based polymers play an important role in manufacturing various types of fibres, adhesive films and carbon of high mechanical strength. Adhesives for bonding polyester fibres and rubbers have also been prepared with the help of biphenyl derivatives.

A primer solution derived from biphenyl showed good adhesion property. Biphenyl based polymeric products have also been found useful in structural determination of polymers, in manufacturing electrophotographic photoreceptors, wire coatings, lithium battery additives, dental and optical materials expoxy resins, etc.

Thus, in the present manuscript a literature report covering the details of biphenyl-derived polymers and their applications have been forwarded.

1. In preparation of fibres with high strength components :

The compounds suitable for manufacturing fibres with high mechanical strength have been prepared with the help of biphenyl carboxylate derivatives[1]. The fibres showed young modulus 2082 km/mm^2, elongation 10.0% and knot strength 4.75 g/denier.

The process for the manufacture of carbon fibres with high strength comprises infusiblization of acrylic fibres under organic compound (e.g. dinitrobenzene) vapour at 180-300^0 C and carbonization at 800-2000^0 C ni an inert atmosphere[2].

2. In manufacturing adhesives and adhesive films:

Biphenyl based adhesive have been synthesized for bonding polyester fibres and rubbers. The adhesive composition comprises ortho-phenyl phenol, para-pheyl phenol, di-methyl terphthalate, biphenyl, methyl salicylate ester, benzoic acid and /or salicylic acid in proper ratio[3].

The adhesive films prepared with the help of 3,3' 4,4'- biphenyl tetra carboxylic dianhdride may be used for manufacture of laminated sheets or lamination of semi conductor chips and lead frames[4] .

The halogenated butadiene-styrene rubber adhesives[5] compring halogenated 1, 1'-biphenyl-4,4'-dicarboximidic acid when applied to two vulcanized SBR pieces and bonded at 150^0 for 30 min to form a bond with adhesive strength 94 kg/cm^2 and no failure after 24h of 100% elongation at 100^{0}C.

A diacetoxy biphenyl copolymer based film showed thermal conductivity 0.0004 W/mk both initially and after 10 days in the manufacture of a thermally insulated containers[6].

A primer solution containing biphenyl compound when applied on the surface an iron substrate, dried and then vapour deposited with monochloro-di-p-xylene gave coating with good adhesion property[7].

3. In synthesis of various types of polymeric compounds:

(i) Biphenyl-based polymers in structural determination of other polymers: A polymer synthesized from the polycondesation of 2,2' – bis (trifluoromethyl)-4,4' biphenyl dicarbonyl chloride with 2,2'-bis {w[4-(4-(4-cyanophenyl)-phenoxy-n-alkoxy carbonyl)]}-4,4'-biphenyl diol, was used to illustrate the novel band structures in a combined main-chain/side-chain liquid crystalline polyster from liquid crystal to crystalline states[8].

(ii) Polymeric compounds in preparation of electrophotographic photoreceptors:

A polymer prepared from N, N'-diphenyl-N,N'-diphenyl-N,N'- bis [4-ethoxy carbonyl ethyl phenyl) phenyl] [1, 1' biphenyl]-4,4' diamine; ethylene glycol and isophthaloyl chloride, was specially used in electro-photographic photoreceptors and organic electronic devices. The electro-photographic photoreceptors are electric charge transporting polymers[9]. Other such type of photoreceptors with superior durability have also been synthesized[10].

(iii) Polymeric compounds in manufacturing wire coatings :

A fully imidized creylic acid, sol. Polymers comprising 4,4'-oxydiphthalic anhydride (ODPA):3,4,3'4'-biphenyl tetracarboxylic dianhdride (BDPA); 3,4' oxydianiline (ODA), and 4,4'-oxydianiline can be used as a wire coating material[11].

(iv) Biphenyl – based polymers in overcharge protection of secondary non-aqueous lithium batteries.

The title batteries can be protected against overcharge abuse by incorporating small amongs of suitable aromatic additives into the electrolyte[12,13,14]. The additives are electrochemical polymd at abnormally resistance of the battery and thus protecting it. The additives biphenuyl, 3-chlorothiophene, and furan are especially suitable for certain Li-ion batteries.

(v) Biphenly-based polymers in preparation of dental filling.

The materials containing co-polymers of diphenic esters have been used in dental filling[15].

(vi) In the manufacture of some useful polymers :

Biphenyl could be efficiently converted into biphenyl-cis-2,3 dihydrodiol which is useful for manufacturing polymers by a mutant strain of Pseudomans pseudoalcaligens KF707 in a liq. % oil interface of solutions in an angular cell[16].

4. In the preparation of epoxy resins for sealing semi-conductor devices :

Biphenyl-based epoxy resin as one of the important constituents showed lower elasticity and lower internal stress than the conventional resins, and has excellent adhesion to lead fram of semiconductors[17].

The biphenyl type epoxy resin compositions also possessed good flow ability and smooth heat release[18], good head and moisture resistance, excellent mold releasing property[19], and high solder resistance[20].

The epoxy resin composition free from halogen and antimony containing biphenyl derivatives showed good flam resistance and reliability[21, 22].

5. In the manufacture of resins for optical materials:

The transparent heat resistant resins with low density and good process ability containing di(meth) allyl-2,2-biphenyl dicarboxylate have shown good heat resistance[23].

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