Preparation of polyaniline/cyanoethyl resin blends

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Abstract

Electrically conducting polyaniline/cyanoethyl resin (PANI/Cyan) blends were prepared by *in situ* polymerization. The mechanical properties of the blend films increased with increasing cyanoethyl resin and the blend films have moderate conductivity.

Introduction

Widespread utilization of polyaniline (PANI) is limited due to its poor solubility and mechanical property [1]. Blends formed by conducting polyaniline (PANI) and an insulating polymer constitute a novel class of conducting materials, which present attractive mechanical and processing performance. These blends are normally obtained by *in situ* polymerization of aniline in the presence of the insulating polymer [2]. Cyanoethyl resin has a good solubility in organic solvents and good film formation property. Therefore, poor mechanical properties of polyaniline can be overcame by blending with cyanoethyl resin.

Experimental

1. Materials
Aniline (Aldrich) was distilled under reduced pressure, cyanoethyl resin and other reagents were used as received.

2. Synthesis of polyaniline/cyanoethyl resin (PANI/Cyan) blends
Aniline was added to the 1M PTSA aqueous solution and stirred for 2h. To the solution, an 1M aqueous solution of PTSA containing ammonium persulfate was introduced dropwise at –2 °C with stirring, to polymerize the aniline. Then, cyanoethyl resin/DMF solution was added at the desired proportion to the polyaniline solution with vigorous stirring for about 24h. After the reaction, the green powder was precipitated in a form of PANI/Cyan salt doped with PTSA. After washing process, the precipitated PANI/Cyan was filtered with Büchner funnel, and then dried in vacuum at 50 °C for about 24h.

3. Preparation of polyaniline/cyanoethyl resin blend solutions and films
The PANI/Cyan powder was dissolved in m-cresol until a homogeneous viscous solution was obtained and PANI/Cyan blend films were prepared by casting the blend solutions onto the glass plate.

4. Measurements
The mechanical properties of blend films were evaluated by the tensile test. For measurement of the electrical conductivity of the blend films, the four-probe method was used with KEITHLEY 238 unit.

Results

The electrical conductivity was affected by the concentration and dispersion of the PANI. During the solvent evaporation, there was a flocculation of the PANI particles. Therefore, the difference of conductivity between glass-contacted surface and air-exposed surface reveals that not only the intrinsic conductivity of the PANI is the key factor but also the extent of dispersion of the conducting polymer in the matrix exerts a strong influence on the electrical properties. The tensile strength and the Young's modulus increased with increasing PANI by 60wt%, however, more PANI made the film brittle.

Conclusions

The solubility of PANI in m-cresol was enhanced by the cyanoethyl resin which has excellent solubility in m-cresol. In comparison with extremely poor mechanical properties of PANI, the blends films of PANI/Cyan are found to have greater mechanical properties and moderate conductivity.

References

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