CHAPTER I
INTRODUCTION

Electroactive materials have been utilized in many applications such as muscle/insect-like actuators, robotics, drug release, and etc (Bar-Cohen *et al.*, 2004). One type of electroactive materials is the electroactive polymer. Electroactive polymers (EAPs) offer promising and novel characters: lightweight, high energy density and high flexibility; they are material candidates for muscle-like actuators. Dielectric elastomers belong to a type of electric-field-activated electroactive polymers that are capable of producing large strains, fast response, and relatively high efficiency (Kornbluh *et al.*, 2000). In particular, an acrylic elastomer is a dielectric material which has many advantageous characters over other dielectric polymers: inexpensiveness, flexibility, low swelling in water, high tensile strength, good resilience, and high respond under electric field. These characteristics are desirable properties required to induce large actuation strain when subjecting the material to an electric field.

Conductive Polymers, CPs, (Chandrasekhar *et al.*, 1999) are intrinsically conducting polymers without the presence of any conductive filler. The unique intrinsic conductivity of these organic materials, which generally are comprised simply of C, H, and simple heteroatoms such as N and S, and the myriad of properties emanating from it arises uniquely from the n-conjugation. Fairly extended and delocalized conjugations originate from the overlap of n-electrons. Poly(p-phenylene), PPP, is one of conductive polymers that has been explored because of its has high chemical resistance, electroluminescence, and high electrical properties.

Recently, incorporation of a conductive polymer into a dielectric elastomer forming a polymer blend has been of keen interest. Conductive polymers can offer a variety of benefits to the host elastomer: variable conductivity, improved thermal stability, and mechanical properties (Wissler *et al.*, 2005). Examples are polyanilene-polyisoprene composite for biosensor application, polyanilene-EPDM composite (Hiamtup *et al.*, 2007), and TiO_2 embedded in PDMS gels for actuators application (Feher *et al.*, 2001).

In our work, we developed the various types of dielectric elastomers and the polymer blend between poly(p-phenylene) and Nipol AR71 elastomer blends as candidates for artificial muscles or actuators. The thermal properties, electrical properties, and electrorheological properties are investigated in terms of elastomer types, poly(p-phenylene) particle concentration, temperature, DC electric field strength, and frequency of AC electric field.