Chapter 1

Introduciton

For the past decade and a half, many different types of piezoelectric ceramic-polymer composites have been developed intended for many applications such as hydrophones, biomedical transducers,…,etc.. The properties of materials are the important factors to design the applications. The drive for the rapid development of composite materials stems from the need for a combination of desirable material properties that often cannot be obtained in single-phase materials. This is due to the composite materials properties which indicate advantages over the single-phase ceramics. For example, the properties of single phase ceramics, mainly lead zirconate titanate (PZT) exhibited high dielectric constant, strong piezoelectric charge coefficient (d_{33} and d_h), large electromechanical coupling coefficient (k_p) and dielectric constant (K), and low dielectric loss ($\tan\delta$). As a result, piezoelectric ceramics are the most common transducer materials used today. Besides, they show high densities

that lead to large characteristic acoustic impedances, necessitating the usage of matching layers. The large dielectric constant of these materials facilitate electrical tuning, but also significantly reduce their piezoelectric voltage coefficients. Piezoceramics also have a large mechanical quality factor (Q_m) and require the addition of damping backings to reduce ringing to an acceptable level. Finally, ceramics are brittle, probably not flexible enough to suit a curved surface and noncomfortable. These properties of ceramics lead to high acoustic impedance which mismatch with acoustic impedance of water or human tissue. Therefore, applying piezoceramics to produce composite is very necessary for use as transducers in hydrophone and ultrasonic biomedical imaging applications. In this study, the lead zirconate titanate and polyester resin were prepared to composites by using centrifuge technique. The piezoelectric properties (d_{33} and k_p), the mechanical properties (density, ρ, and acoustic impedance, Z) and the microstructure of the composites were characterized.