CHAPTER 5

CONCLUSIONS

5.1 Powder Processing and Characterization

A modified chemical method using spray drying technique followed by calcining using low-purity and low-cost chemicals has been developed to produce fine, homogenous and high purity PZT powders. The round-shape particles of PZT phase started to form at 500 ^{o}C and the complete crystallization occured at about 850 ^{o}C. The particles grew accordingly as temperature rose and no impurity was detected. The values of the grain size, piezoelectricity, dielectricity and densities of the ceramics sintered from the spray-dried PZT powders were among those of the ceramics produced from high purity chemicals.

For PZT powder prepared from the conventional mixed oxide method, the PZT phase can be formed when the calcining temperature is about 800 °C with the trace of unreacted ZrO_2 was found in the calcined samples, but it was not detected in the sintered samples which the single phase of tetragonal perovskite could be obtained.

5.2 Composite Processing and Characterization

A combination of suction, dice and fill techniques, a new type of PZT/epoxy resin composites combining 0-3 and 1-3 connectivities were fabricated. The measured piezoelectric coefficient (d_{33}) and coupling factor (k_p) were 25.3 pC/N and 0.61 for PZT(m)/epoxy resin, respectively, while that of PZT (sp)/epoxy resin were 20.2 pC/N (d_{33}) and 0.54 (k_p). Moreover, the very low acoustic impedance obtained for both PZT/epoxy resin composites,4.12 Mrayls for PZT(m)/epoxy resin and 4.84 Mrayls for PZT (sp)/epoxy resin, which have a potential for these composites to be used in biomedical applications since these acoustic impedance values are very close to that of human tissue and water.

5.3 Suggestion for Future Work

In the present work, the dielectric and piezoelectric properties of the combined composites are mainly depent on the connectivity, dispersed phase and poling process. The following suggestions are therefore, recommended for the future work on the piezoelectric of the composites.

1. Low density, high permittivity and good adhesive polymer should be employed as the matrix phase since these properties could enhance the energy transfer and reduce the loss factor.
2. The corona discharge method should be employed in the poling process.