CHAPTER V
CONCLUSIONS

In the presence of the electric field, all of the ER fluid samples (silica, polyaniline, and polyaniline-coated silica systems) showed the linear viscoelastic behavior only at small strain amplitude due to the deformation of the chain-like structure. The response time to the external electric field of 2 kV/mm of all samples was approximately 100 s. At zero electric field strength, the ER samples behaved like a viscous fluid in which the G" was much higher than G' for the entire range of frequency. With an applied electric field, in the linear viscoelastic region, the storage modulus was larger than the loss modulus. This can be explained by the elasticity of the ER fluid, which was dominated by the particle chain structures under an imposed electric field. At a critical frequency, there was a transition from a solid-like to a liquid-like state, G' and G" crossovered each other. Above this critical point, the viscous behavior was more dominant. In oscillatory measurements, the storage and the loss moduli increased with increasing electric field strength, due to the stronger electrostatic force between the particles in the chains. The influence of the particle concentration on G' and G" was weak at low particle concentration, the chains were not completely expanded across the gap but they formed separated short chains or attached to only one electrode. At higher particle concentration, the number of particle chains increased, the rearrangements of the chains may include crosslinking to construct a network structure, because isolated chains segments can be formed between the fully developed chains, resulting in a larger ER effect. In nonlinear viscoelastic region, at 600% strain, the viscous contribution to the total dynamic response was dominant, only loss modulus was present. Further more, the ER effect in nonlinear viscoelastic region was smaller than that of linear viscoelastic region, due to the large deformation of the chain structures.