ABSTRACT

Barium ferrite is widely used as permanent magnets because of its large coercivity and low cost .The magnetic properties are strongly affected by the preparation method.

The present work deals of the study of the effect of preparation conditions of hexagonal barium ferrite on the magnetic properties. In addition powders of the optimized properties have been used with natural rubber to produce flexible magnet. The study could be summarized as follows:

1- By using chemical co-precipitation method, barium ferrite ($BaFe_{12}O_{19}$) powders characterized by high dispersibility and coercivity, narrow particle size distribution and high chemical homogeneity have been successfully prepared. Taking into account 11 preparation parameters we controlled the final quality of the powders. The precursor was divided into six types depending on particle size and size distribution.

2- Both Optical Microscope and Electron Probe Microanalysis EPMA were used to clarify some critical points in the particles morphology. The results indicated that the powders having large particles and narrow size distribution exhibit better magnetic properties than those with fine and multi size distribution due to their high porosity, saturation molar ratio and homogeneity. The final powders possess high coercive force (5.85 KOe) and saturation magnetization (71 emu/g), which are very closed to the theoretical values.

3- Optimized powder (excluding the fine) was used as magnetic filler to natural rubber NR. The effect of barium ferrite loading on the magnetic properties was studied for $BaFe_{12}O_{19}$/ NR composites. The results showed an improvement of the coercivity of the composite after mixing with rubber and the saturation magnetization is linearly dependent on the mass fraction of the filler as compared with free hexagonal barium ferrite .

5- The composite tensile strength, strain at break and Young modulii were highly influenced by the size, shape of the particles and volume fraction of ferrite. Both elongation and strength at break decrease with increasing filler content , whereas Young modulus increases.

6- Some thermal degradation occurred in ferrite/ NR composite due to the aging at 70 °C. The degradation increased after 15 days, whereas a stability of the mechanical properties started beyond 30 days of aging.

7- The dynamic properties of barium ferrite/ NR composites have been studied , . The results showed that, both storage ε', loss ε'' modulii and tan δ increase with increasing ferrite loading . Their values are strongly depend on the particle-particle and particle-matrix characteristics.

7- The final characteristics of the rubber-ferrite composites at the maximum ferrite loading, are H_c = 5.3 KOe, M_s = 37.12 emu/g, density = 2.21 g/Cm^3, BH_{max}= 1.17 MGOe , stress at break = 5.3 MPa, elongation at break = 48 %, storage modulus = 6.3 MPa, hardness= 44.5 , and resilience = 0.84 .