Thermoelastic Vibration of Magnetic Field Sensitive Silicone Elastomers

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Recently there has been an increasing interest in the development of smart materials. They are novel structures whose physical properties can change significantly in a controlled fashion by external stimuli, such as light, heat, temperature, magnetic or electric fields, etc. Materials that respond in such a way with a magnetic field can be developed using microparticles of iron in an elastomer matrix. In this work the characterization of thermoelastic vibration of thin silicone elastomers layers with micrometric of iron is reported. The photoacoustic technique is specially suited for the measurement of thermal and thermolastic properties of materials, due to the fact that it is able to detect not only the thermal waves but also the vibration of the material generated by the thermoelastic effect. In order to get an alternative technique, the measurements were also performed using the deflection of a probe laser beam impinging on the surface of the vibrating sample. The thermoelastic effect was stimulated using a laser beam of 200 mW impinging on the sample. At the same time magnetic fields in the range of 100 to 500 gauss were applied. The results show that the thermoelastic vibration amplitude is strongly affected by the magnetic field. The effect of the increase of the volume fraction of microparticles is analyzed, showing a decrease in the thermoelastic vibration amplitude, due to a higher rigidity of the material, reaching saturation for very high particle concentrations.