

Vibrating sample magnetometer using multilayer piezoelectric actuator

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The vibrating sample magnetometers (VSM) have been widely used, as standard magnetic equipment, for measuring the magnetic properties of various materials because of their accuracy and sensitivity [1, 2]. The sensitivity of VSM is determined by product of vibrating amplitude and frequency. In general, the sample is mechanically vibrated using a speed-controlled motor with cam or an electromagnetic transducer in several tens Hz, in spite that the higher frequency the higher sensitivity. And the small sizing of conventional VSM is difficult because the sample and pick-up coils must be sufficiently away from the magnetic field generated by vibration mechanism. This field affect to pick-up coil as a noise signal. In this study, the new VSM with piezoelectric vibrating mechanism has been developed to achieve the high sensitivity and small sizing of VSM. The magnetic sample is settled on the end of cantilever of which the displacement is occurred by a multilayer piezoelectric actuator (MPA)[3]. The advantage obtained by using a MPA is that strong force on cantilever in high frequency, which make large vibrating amplitude to be possible, can be generated by relatively low excitation voltage. In addition to this, the vibrating mechanism do not generate the extra electromagnetic noise. Figure 1 shows the schematic view of the proposed VSM (piezo-VSM). The quartz bar with 5 mm in diameter and 21.5 cm long was elastically fixed to form the cantilever and vibrated by MPA. The end of cantilever and/or sample was displaced about 5 mm at 81 Hz. The piezo-VSM shows high sensitivity due to extremely large displacement. Actually, figure 2 demonstrates the sensitivity of piezo-VSM by comparison between two output signals of Co base amorphous wire. Although only one pick-up coil was used in piezo-VSM, a magnetization of a few μ -emu can be detected clearly.

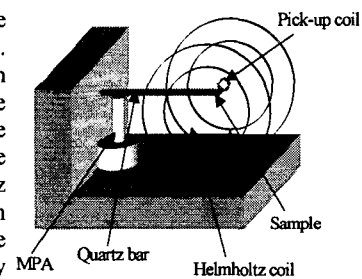


Fig.1. Schematic view of piezo-VSM.

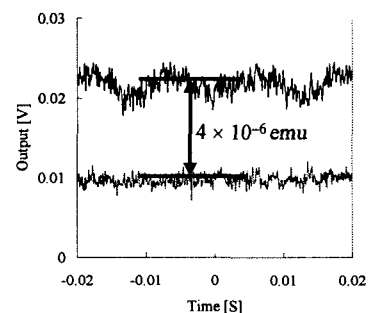


Fig.2. Output of piezo-VSM.

References

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