EU10

Observation of Second Harmonic Generation in Magnetic Fluid Film With an Applied Magnetic Field

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Until now, the researches and experiments about optical properties of magnetic fluid (MF) are mainly focused on the linear effects. In an external magnetic fields, light attenuates after passing through the MF depends on the magnetic field. According to some reports and our experiment, the attenuation of infrared light is not sensitive to the field.

The contribution of second harmonic generation (SHG) to the total intensity of light is not considered in the above conclusion. When magnetic fluid is isotropy, no SHG happens when light enters into the MF. However, the isotropy will be destroyed in the external field because of the formation of magnetic chains through agglomeration, hence SHG becomes possible. Compared with incident light, second harmonic (SH) intensity are usually very weak. In our paper, we used 1064 nm infrared laser as the incident light, and imposed magnetic field with different values on the MF samples. After light passed through the samples, SH signal (532 nm) was observed by filtering out the 1064 nm lightand detected by a lock-in amplifier sysytem. The experiment shows that the intensity of SHG produced by MF increases with the magnetic field, and trends to a maximum value. No significant difference appeared when the samples with different thickness were used.

In future, we will investigate the SHG signal instantaneously, so that the agglomeration process in a magnetic fluid film with an external magnetic filed can be better understood.

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EU11

Magnetism and Mechanical Property of Fe-Pd-Rh Alloys

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The research reports that the bulk ferromagnetic shape memory (FSM) Fe-30Pd-2Rh (at%) alloys were forged to produce a ~ 55% reduction in thickness. Then through thermal annealing at 950 ~ 1100°C for various times and quenching in ice brine were carried out to induce a recrystallization. Following investigation with Vickers microhardness test reveals that the process of recrystallization has resulted in the fine grain having increased ductility. The vibrating sample magnetometer (VSM) test also indicates that the strain-forged specimen with complete recrystallization can contribute a high saturated magnetization as well as a high magnetic anisotropy. The high mechanical ductility and high magnetic anisotropy will provide improved magnetostriction in the FSM Fe-30Pd-2Rh alloys for use in magneto-mechanical applications [1-4].

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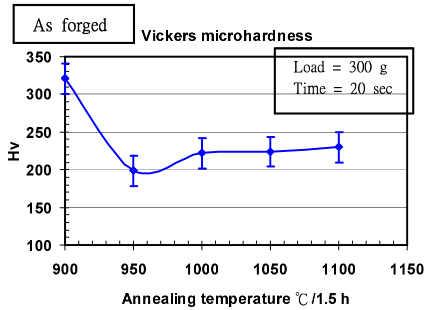

Fig. 1. The Vickers microhardness of the alloys with strain-forged a (~55%) reduction in thickness then through thermally annealing at various temperatures for 1.5 h and quenching in ice brine.

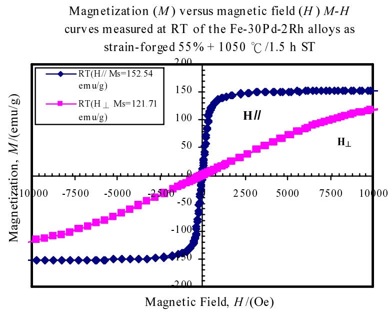

Fig. 2. Magnetization (*M*) versus magnetic field (*H*) *M-H* curves measured at RT of the Fe-30Pd-2Rh alloys strain -forged a 55% reduction in thickness and annealing at 1050 °C for 1.5 h then quenching in ice brine. H⊥denotes the magnetic field was applied perpendicular to the sample's cross section.

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