Magnetic Condensation of Rare Earth Ions Ⅱ

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Magnetic separation is a technique to separate mixed substances using a magnetic force. In the early stage, the target is limited to ferromagnetic materials with large particle sizes. However, recent studies have also targeted paramagnetic ions. [1][2] The magnetic force F for an ion with magnetic susceptibility κ_{ion} under the influence of magnetic flux density B is expressed by Eq. (1).

$$F = \kappa_{ion} B \left(\frac{dB}{dz}\right) \quad (1)$$

In this study, the target of magnetic separation was rare earth ions. Rare earth metals are indispensable for producing high-tech products and their demand is expected to increase hereafter. Magnetic separation is an effective technology for recycling them for stable supply.

From the above, we researched about magnetic separation experiment of rare earth ions in aqueous solution. An aqueous solution of $DyNO_3 \cdot 6H_2O$ (99.5%, FUJIFILM Wako Pure Chemical Corporation) was sealed in a glass cell, and a magnetic field was applied by Halbach-array permanent-magnet. Fig. 1. showed the experimental system. It was constructed to obtain concentration changes from light interference fringes with a Mach-Zehnder interferometer. Fig. 2 showed the interferograms in the upper area of the cell. The changes of interference fringes corresponding to Dy ion concentration were observed and we confirmed the enrichment occurred 20s after the start of magnetic field application. We plan to quantify how much the concentration has changed by analyzing the interferograms.

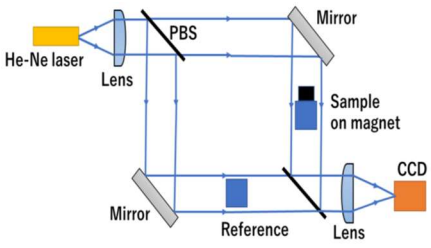
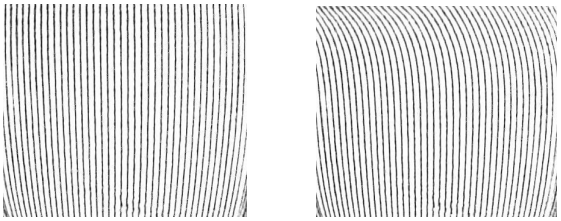


Fig. 1. The optical detection system with a Mach-Zehnder interferometer. PBS denotes polarizing beam splitter.



(a) (b)

Fig. 2. The interferograms (a)without the magnetic field application and (b)20s after the start of magnetic field application.

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References: [1] Agnieszka Franczak et al., Phys. Chem. Chem. Phys. 18 (2016) 27342.
[2] H. Horii, K. Kimura, and I. Yamamoto, 68th JSAP Spring Meeting, 16a-Z19-9, Abs. p. 09-010.