

## 10. Separation of Okra, Morning Glory, and Rice (Videos: 18–20)

### <Explanation>

Okra seed, morning glory seed, and rice were put in a solution of gadolinium chloride (0.60 mol/kg) for magnetic separation by the use of magneto-Archimedes levitation. **Videos 18–20** show the behavior of these plant seeds while the flux density is raised from 0 T to 1.5 T, the process of which is photographed from the vessel side surface at intervals of 2 seconds.

Observations show that that okra levitates at 0.66 T, morning glory at 1.27 T, and rice at 1.95 T. The values of  $B_z \cdot dB/dz$  at the time of levitation are  $-2.2$ ,  $-6.8$ , and  $-17.5$  T<sup>2</sup>/m, respectively. Since the density of the bio-specimens is close to that of the solution, the effect of magneto-Archimedes levitation is eminent. Therefore, this is an advantage for easy magnetic levitation and separation even in the field of weak magnetism.

This experiment was repeated several times in order to confirm its reproducibility. **Videos 18–20** show these cases. The empirical conditions were kept unchanged in all cases.

### <Place of execution>

National Institute of Advanced Industrial Science and Technology, Kansai

### <Research paper>

S. Maki and M. Ataka,

“Magnetic levitation with permanent magnet: application to three types of plant seed,”

*Japanese Journal of Applied Physics* **46**, No. 5A, pp. 2910-2911 (2007).