

Development of an Elemental Analysis System using Negative Muon Beam

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The intense pulsed muon source at J-PARC MUSE can generate the decay muon beam since 2009 [1] and the pulsed negative muon (μ^-) is available for elemental analysis because characteristic muonic X-rays are emitted from the irradiated samples. However, the method of quantitative analysis has not been established in the present stage. In this presentation, we will introduce the new elemental analysis system.

The system is mainly composed of an aluminum chamber and an electromagnet. The magnet can bend the negative muon beam below; the incline angle is 45 degrees. A sample is put on a beryllium plate that is set in the aluminum chamber. Because the Al chamber has a loading hatch and the sample need not be hung, user can easily exchange the sample. The water-cooled magnet can bend the muon beam with the momentum of 47 MeV/c according to calculations and the system can record depth profile of a solid sample by changing the momentum.

In the quantitative analysis of muonic X-ray, a radiation shielding material around a detector is very important. In the new system a Ge detector is covered with an X-ray shield made of lead lined by Cu plate. The shielding body can significantly reduce x-ray noise. Now we are developing the analytical system to measure extraterrestrial samples.



Fig. 1 Negative-muon-induced X-ray analysis system developed in this work.

References

[1] Y. Miyake et al. Nucl. Instrum. Meth. Phys. Res. A **600** 22 (2009)..