Department of Applied Nuclear Technology

Key words Magnetic force control and application, magnetic separation, Superconducting magnet, contaminated soil and water, water treatment, specific gravity separation, particle aggregation/dispersion

Doctor of Enginnering / Professor

Fumihito Mishima

Education

Department of Electrical Engineering, Faculty of Engineering, Kogakuin University, Graduate School of Electrical Engineering and Electronics, Master's Program, Osaka University Graduate School of Engineering, Department of nuclear engneering (Doctoral Program)

Professional Background

Project researcher / Assistant Professor (full time) at Osaka University,
Associate Professor, Professor at Fukui University of Technology

Consultations, Lectures, and Collaborative Research Themes

Lectures and technical consultations from basics to applications for purification of contaminated wastewater and soil, specific gravity and magnetic separation of valuable resources , evaluation on dispersion and aggregation of target substances

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Main research themes and their characteristics

「Development of scale (crud) removal technology in high temperature and high pressure piping using magnetic force」

Since the accident that happened in The Fukushima Daiichi Nuclear Power Station, a scattered radiological decontamination and decommissioning technology are attracting a lot of attention. The removal of radioactive crud in the nuclear power plant will become one of the more important elemental technologies of the decommissioning from now on. However, the effective technique to remove the crud which is applicable at high-temperature area around the nuclear power plant does not exist. Therefore, we focused on the magnetic property of the target cruds which are paramagnetic substance and high gradient magnetic separation (HGMS) was proposed as a nuclear power plant crud removal method.

The (HGMS) magnetic separation experiment was conducted under controlled pH and Zeta potential of the crud sample suspension to be dispersed. The experimental results were found to shows good agreements with the calculated results.

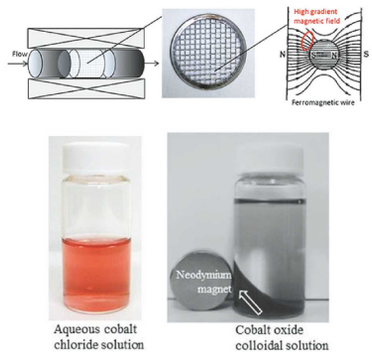

Fig.1 Schematic diagram of HGMS and magnetic flux lines near the ferromagnetic wire, photograph of imitational crud sample applied magnetic field.

「Advanced magnetic separation of paramagnetic materials using fluid control」

Removal of radioactive crud in the nuclear power plant will become one of the most important issues. The effective technique, which is applicable at high-temperature area in the nuclear power plant does not exist. We focused on the magnetic property of the targeted crud materials and found they shows para-magnetism and hence high gradient magnetic separation (HGMS) was studied to remove the cruds in the nuclear power plant. In this study, we made a removal experiment of Hematite which simulated the cruds by means of high gradient magnetic separation. The magnetic separation experiment was conducted under constant flow velocity. We controlled pH and Zeta potential of the Hematite suspension to be dispersed. The experimental results were found to shows good agreements with the calculated results.

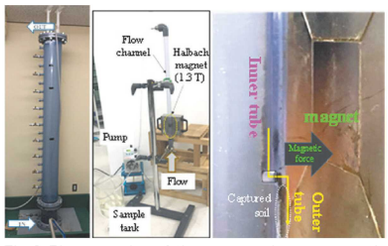

Fig.2 Photographs of the captured paramagnetic soil (dashed circle) using by the selection tube applied a magnetic field.

Major academic publications

F. Mishima,N. Nomura, S. Nishijima ,"Study on multi-stage magnetic separation device for paramagnetic materials operated in low magnetic fields ", Progress in Superconductivity and Cryogenics, 25 (3) ,pp13-17 (2023)

F. Mishima,N. Nomura, S. Nishijima ,"Magnetic separation device for paramagnetic materials operated in a low magnetic field", Progress in Superconductivity and Cryogenics, 24 (3) ,pp19-23 (2022)

F.Mishima, Y.Akiyama, S.Nishijima,"Fundamental Study on Magnetic Separator UsingOxygen Dissolved Perfluorocarbon" , IEEE Trans. Appl. Supercond. 24, NO. 3,Page(s)3700705,(2014).

F.Mishima, S.Hayashi, Y.Akiyama and S.Nishijima"Development of a superconducting high gradient magnetic separator for a highly viscous fluid " , IEEE Trans. Appl. Supercond. 22 Page(s)3700204,(2012)