

超伝導磁気分離による火力発電所給水中からのスケール除去に関する検討

Application of superconducting magnetic separation for the removal of scales from boiler feed water in thermal power plants

物材機構¹, 福井工大², 阪大³, 四国総研⁴, 荏原工業洗浄⁵, °廣田 憲之¹, 岡田 秀彦¹,
三島史人², 西嶋茂宏², 山本 隼也³, 平松 まみ³, 秋山庸子³, 松浦英樹⁴, 難波正徳⁴, 関根智一⁵
NIMS¹, Fukui Univ. of Tech.², Osaka Univ.³, Shikoku Research Institute Inc.⁴, Ebara Industrial
Cleaning Co. Ltd.⁵, °N. Hirota¹, H. Okada¹, F. Mishima², S. Nishijima², J. Yamamoto³,
M. Hiramatsu³, Y. Akiyama³, H. Matsuura⁴, S. Namba⁴ and T. Sekine⁵

E-mail: hirota.noriyuki@nims.go.jp

The thermal power generation is one of the major ways to generate electricity, however, they discharge a large amount of carbon dioxide. Improvement of the energy conversion efficiency in thermal power plants is expected to contribute for reduction of fuel consumption and carbon dioxide emission. A thermal power plant consists of steam turbine generators, boilers and a system to feed water to boilers. Deposition of scale in the water circulation system and the boiler degenerates energy conversion efficiency. Therefore, reduction of scale seems to contribute to decrease fuel consumption and carbon dioxide emission.

Most of scales consist of iron oxides. Iron dissolved in boiler feed water from walls of pipes and devices at relatively lower temperature part, and then, flows in the boiler. When temperature of water exceeds about 200°C, most of irons form magnetite (Fe_3O_4) and deposits on wall of pipes. Magnetite can be separated magnetically from the boiler feed water. Therefore, we are studying the way to adopt the high gradient magnetic separation technique to this system. In case of the high gradient magnetic separation, the matrix that consists of ferromagnetic wire sheets is set in the flow path located in a superconducting magnet bore. Magnetite particles attracted to magnetized wires due to the magnetic force. Preferable position to set the magnetic separation system in the feed water circulation path, suitable matrix structures, required condition of superconducting magnet, operation condition and procedure have been studied based on simulation and experiments. In case of AVT type thermal power plants, one of the suitable locations to install the separation system seems to be the drain of high pressure heater where a part of feed water flows. In there, the concentration of scale is relatively high and the quantity of flow is around 400 to 500 m^3/h in 200°C and 20 atm. We found a candidate of the matrix structure for efficient separation. Recent progress of this study will be reported in this presentation.

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