ABSTRACTS (MASTER THESIS)

Study and Development of Microwave Irradiating System for a Woody Biomass Refinery

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Woody biomass consists of cellulose, hemicellulose, and lignin. In the woody biomass, lignin coats on the cellulose and hemicellulose which call lignocellulose. This thesis presents improvement of a microwave irradiating launcher for lignocellulose pretreatment for creating bioethanol. It also presents study and design of a container which is irradiated with electromagnetic wave for reactive tests of a catalyzer in order to create a functional polymer from lignin. First of all, the permittivity of materials was measured with temperature. The measured permittivity data is useful for designing the microwave irradiating system. From measurement results, the microwave penetration depth and absorbed power in the materials were calculated. Secondly, a simplified launcher of pretreatment system was designed by 3D electromagnetic simulator. The simplified launcher design was conducted by adjusting the input impedance of the metal pipe filled with the woody-biomass mixture. As a result, the launcher without the tuners provided the reflected power of less than 1 %. Next a multi-port microwave-irradiating system was developed for a bench-scale plant. Figure 1 shows designing of a multi-port microwave-irradiating system by 3D electromagnetic simulator. From practical measurement results, the absorption efficiency of the apparatus realized about 80 %. Thirdly, a coaxial reaction container irradiated with electromagnetic wave was developed in a wide frequency range from 80MHz to 2.7 GHz. The coaxial container was designed in the 3D FEM simulator and a prototype was developed. As a result, the coaxial container provided the reflected power of less than 10 % above the frequency of 0.85 GHz when the container filled with distilled water at 30 ºC. From the heating test with a high power amplifier, distilled water was heated above the 100 ºC by both 915 MHz and 2.45 GHz electromagnetic waves in the container.

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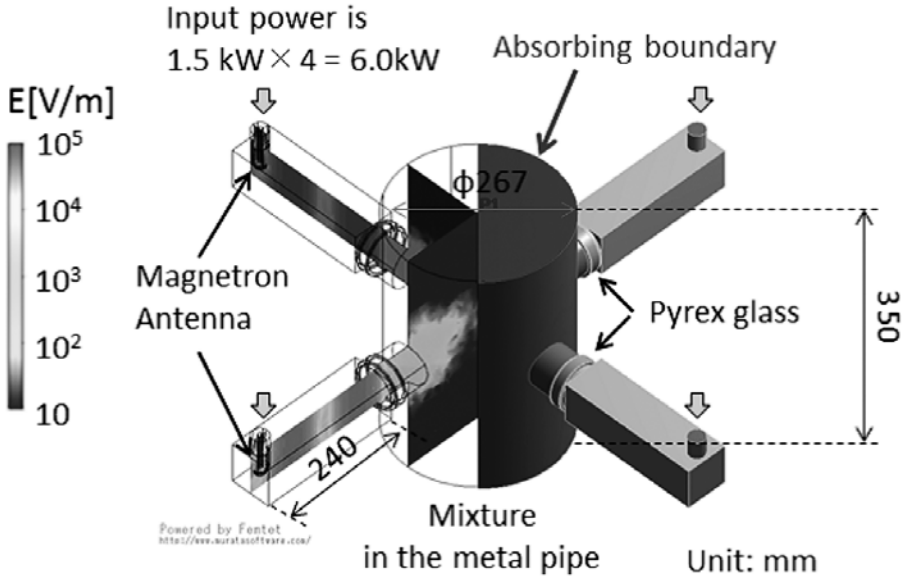

Figure 1. Designing of a multi-port microwave-irradiating system by 3D electromagnetic simulator.