Measurement of Optical Properties of Construction Materials in the Terahertz Region

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***Abstract*- Refractive indices, attenuation coefficients and reflectance of construction materials including gypsum boards and rock wool ceiling plates are determined in the terahertz region with time domain spectroscopy (TDS). The measurement shows careful consideration needs to use these constants for modeling of THz indoor-application systems because the construction materials are inhomogeneous and random media.**

I. Introduction

Measurement of optical characteristics of construction materials is necessary for developing indoor terahertz sensing systems, for example, used by rescue corps in collapsed and/or burning buildings. The indoor THz short-range high-speed wireless communication system is another important application [1]. So far electromagnetic characteristics in millimeter at 62GHz and 70 GHz [2] and terahertz waves below 0.35 THz [3] are measured for plaster, glass plates and other few materials. Our research presents optical constants of commercial construction materials at higher terahertz frequencies.

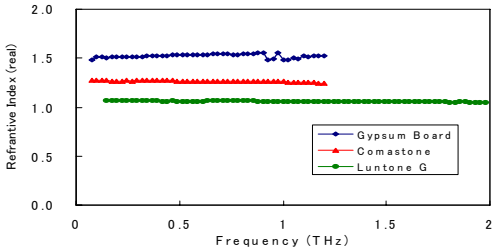

Figure 1. Real part of refractive indexes of construction materials.

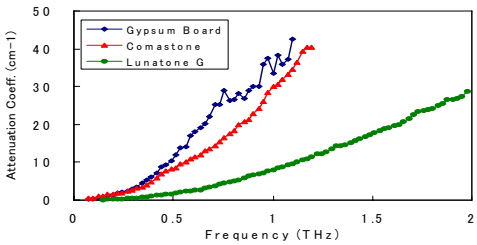

Figure 2. Attenuation coefficient of construction material.

II. Measurement and Result

Samples are commercial gypsum boards and rock wool ceiling plates of acoustic and insulation material. Transmission and reflection measurements have been performed with THz TDS systems made by Tochigi NIKON Co. Measured frequency range is 0.1 to 4 THz and spectral resolution is smaller than 0.06 THz.

Results of measurement are shown in Figures 1 to 3. These constants are due to a mixture of inhomogeneous mineral materials as well as air. Disorders at a surface of materials are also important. The refractive indices at terahertz consist with those in millimeter waves [4].

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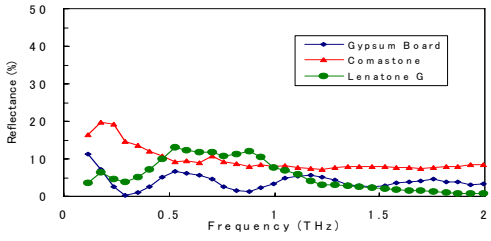

Figure 3. Reflectance of construction materials.