論 文 の 内 容 の 要 旨

論文題目　Application of porous metals in sound absorption technology
（多孔質金属の吸音技術への応用）

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Porous metal is a suitable candidate for acoustic liner in the jet engine as it can attenuate sound in wide frequency band and endure high pressure and high temperature environment. Many researches have been conducted various to study the sound attenuation by porous material under normal incident sound wave in the absence of flow. However, air flow and oblique incident sound wave exist in inside the nacelle of jet engine. Therefore, the sound attenuation by porous with the presence of air flow and under oblique incident sound wave that is similar to the condition inside the jet engine should be investigated.

The first step of this study was the characterization of the microstructure of two types of porous metal, sintered fiber and foam. The microstructure characterization is essential because the microstructure of the porous material affect the acoustic phenomena. In the second step, the flow resistivity of the porous sample was investigated. Flow resistivity, that represent how difficult the fluid to flow through a porous material, is widely believed to be related to the sound attenuation inside the porous material. Furthermore, acoustic models also usually require the flow resistivity as one of the input parameters. In the next step, the sound attenuation of the porous metal under normal incident sound waves in the absence of flow was investigated. This step helps to understand the mechanism of sound attenuation inside porous metals as many

acoustic models are available for this condition. Finally, the sound attenuation of porous material was investigated inside a flow duct under two conditions, in the absence of air flow and in the presence of air flow. The sound attenuation under normal incident sound wave inside the impedance tube and under oblique incident sound wave inside the flow duct in the absence of flow was compared. This comparison is expected to investigate the possibility to use acoustic information inside the impedance tube to better understand the phenomena inside the flow duct. Furthermore, the effect of the air flow on the sound attenuation of the porous metal was studied.

The microstructure affect the flow resistivity of the porous metal. Foam samples, which have larger channel dimension, yielded to 1 order of magnitude lower flow resistivity than the sintered fiber even though the porosity is similar. Furthermore, the sintered fiber samples with microstructure inhomogeneity yielded to a higher flow resistivity. This study also indicated that there are two mechanism of sound attenuation inside the porous metal, viscous loss and resonance. Viscous loss is the sound attenuation mechanism inside the sintered fiber samples whereas the resonance is the dominant mechanism of sound attenuation inside the foam samples with low reticulation rate. However, foam material with high reticulation rate has an acoustic characteristic similar to the sintered fiber material, i.e. viscous loss is dominant while the resonance is insignificant. Inside the flow duct in the absence of air flow, the sintered fiber samples attenuated the sound wave in the similar manner with in the condition under normal incident sound waves. Conversely, the foam samples indicated that the sound attenuation mechanism inside the flow duct was different from the condition under normal incident sound waves. The difference of the sound attenuation was significant for the foam sample with low flow resistivity. Furthermore, the air speed affect the sound attenuation of both types of the porous metal samples.