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Authors: Xingchuan Xia, Zan Zhang, Weimin Zhao, Chong Li, Jian Ding, Chenxi Liu, Yongchang Liu

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Acoustic properties of closed-cell aluminum foams with different macrostructures

Xingchuan Xia [1,2], Zan Zhang [2], Weimin Zhao [2], Chong Li [1], Jian Ding [2,*], Chenxi Liu [1], Yongchang Liu [1,*]

[1] *State Key Lab of Hydraulic Engineering Simulation and Safety, School of Materials Science & Engineering, Tianjin University, Tianjin 300354, China*

[2] *School of Materials Science & Engineering, Heibei University of Technology, Tianjin 300401, China*

*Corresponding authors. Prof., Ph.D.; Tel. & Fax: +86 22 85356410.

E-mail addresses: ycliu@tju.edu.cn (Yongchang Liu); djian0122@126.com (Jian Ding).

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As structural materials, closed-cell aluminum foams possess obvious advantages in product dimension, strength and process economics compared with open cell aluminum foams. However, as a kind of structure-function integration materials, the application of closed-cell aluminum foams has been restricted greatly in acoustic fields due to the difficulty of sound wave penetration. It was reported that closed-cell foams with macrostructures have important effect on the propagation of sound waves. To date, the relationship between macrostructures and acoustic properties of commercially pure closed-cell aluminum foams is ambiguous. In this work, different perforation and air gap types were designed for changing the macrostructures of the foam. Meanwhile, the effect of macrostructures on the sound absorption coefficient and sound reduction index were investigated. The results showed that the foams with half-hole exhibited excellent sound absorption and sound insulation behaviors in high frequency range (>2500 Hz). In addition, specimens with air gaps showed good sound absorption properties in low frequency compared with the foams without air gaps. Based on the experiment results, propagation structural models of sound waves in commercially pure closed-cell aluminum