"STUDY OF MATERIAL COMPOSITION EFFECTS ON NOISE AND VIBRATION DAMPING"

M. VAŠINA, L. Lapčík, Jr., B. Lapčíková, V. Urban

Tomas Bata University in Zlin, Institute of Physics & Material Engineering,
Nad Stráněmi 4511, CZ – 760 05 Zlín, Czech Republic
e-mail: vasina@ft.utb.cz, web: www.ft.utb.cz/czech/UFMI
Phone: +420 57 603 5105, Fax: +402 57 603 2121

KEY WORDS
Waste polyurethane foam, particle size, bonding agent, crosslinking agent, concentration, damping, thickness, sound absorption coefficient, transfer damping function

Introduction

A big accent is put on costs reduction, comfort and security increase and environment protection at the present time. Different environmental factors influence our living conditions, e. g. air and water pollution, illumination, noise, vibrations etc. It is necessary to provide steps for improvement of our living conditions. There are a lot of possibilities for the environment improvement. One of these possibilities is recycling of waste materials (e. g. paper, rubber, glass and plastic materials) which are frequently stored in dumps or burned in incinerators. Waste materials can be reusable in automotive, aerospace, furniture, glass and building industry etc. Manufacturers are motivated to reusable their waste materials by different grant programs in order to reduction of produced waste quantity. It has a positive effect not only on environment protection but also on reduction of operating costs of the manufacturers. Application of waste materials for noise and vibration damping belong to one of the ways of environmental protection.
The aim of this work is to experimentally investigate the influence of material structure on noise and vibration damping. The research was applied on waste polyurethane foam materials which were firstly distributed into four groups in terms of particle size. Thereafter, investigated material samples were produced as mixtures of waste polyurethane foam, bonding agent and crosslinking agent. The crosslinking agent mass was determined as the percentage portion (in this case 5 %) of the bonding agent mass on the recommendation of their manufacturer. The material samples were made with different particle sizes, bonding agent concentrations and material thicknesses. There was investigated the influence of these material parameters and excitation frequency on noise and vibration damping.
As a result, the frequency dependencies of the sound absorption coefficient and the transfer damping function were obtained by experimental measurements. It can be concluded that better damping properties of the investigated materials were in general obtained at material samples with different particle sizes, higher material thicknesses, lower bonding agent concentration and higher excitation frequencies.

Experimental

Materials and methods:

Waste polyurethane foam of different particle sizes was obtained from Gumotex, Břeclav, Czech Republic.
Bonding agent was obtained from Kaučuk, Kralupy nad Vltavou, Czech Republic. The type KRASOL NN 22 is an isocyanate-terminated prepolymer prepared from hydroxyl-terminated polybutadiene and a modified diphenylmethane diisocyanate (MDI). The dynamic viscosity was 17 Pa·s at the temperature 25 °C. The density was 0.98 g·cm^{-3} at the temperature 20 °C
Crosslinking agent was obtained from Kaučuk, Kralupy nad Vltavou, Czech Republic.
Sound absorption coefficient measurements were performed by transfer-function method on three-channel signal Pulse multianalyzer Brüel & Kjær type 3560-B-030 in combination with four-microphone impedance tube Brüel & Kjær type 4206 and power amplifier Brüel & Kjær type 2706 in the frequency range of 0 to 6400 Hz.
Transfer damping function measurements were performed by method of forced oscillations on two-channel signal analyzer Brüel & Kjær type 2034 in combination with vibrator Brüel & Kjær type 4810 and power amplifier Brüel & Kjær type 2706 in the frequency range of 50 to 1000 Hz.
Experimental measurements were performed at the ambient temperature of 22 °C.

Results and discussion

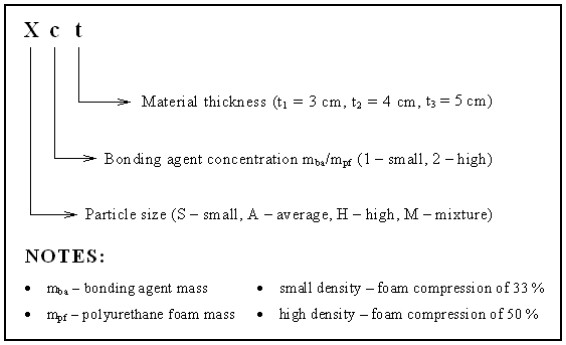

Fig. 1. *Signification principle of the investigated material samples.*

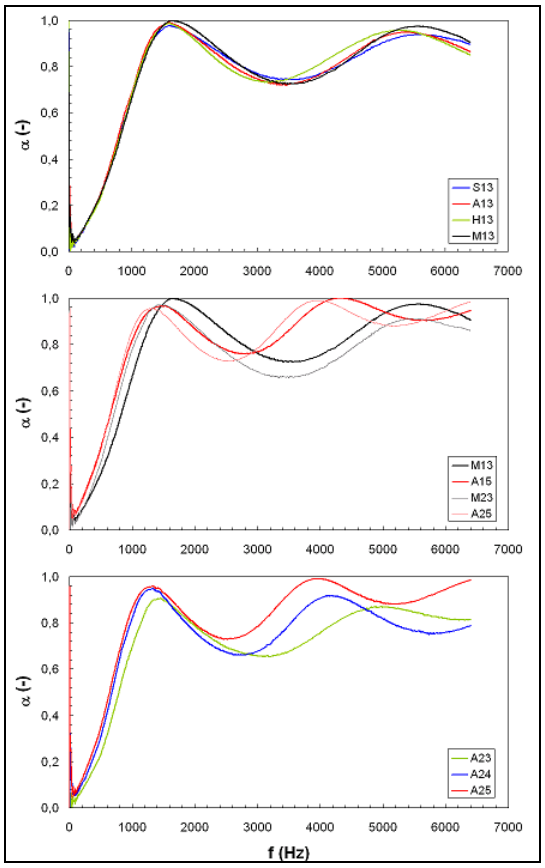

Fig. 2. *Frequency dependencies of the sound absorption coefficient of studied samples.*

Conclusions

The material composition is influenced by many parameters and has a big effect on damping properties. Utilization of recycled waste materials in order to noise and vibration belongs to positive aspects of environmental protection.

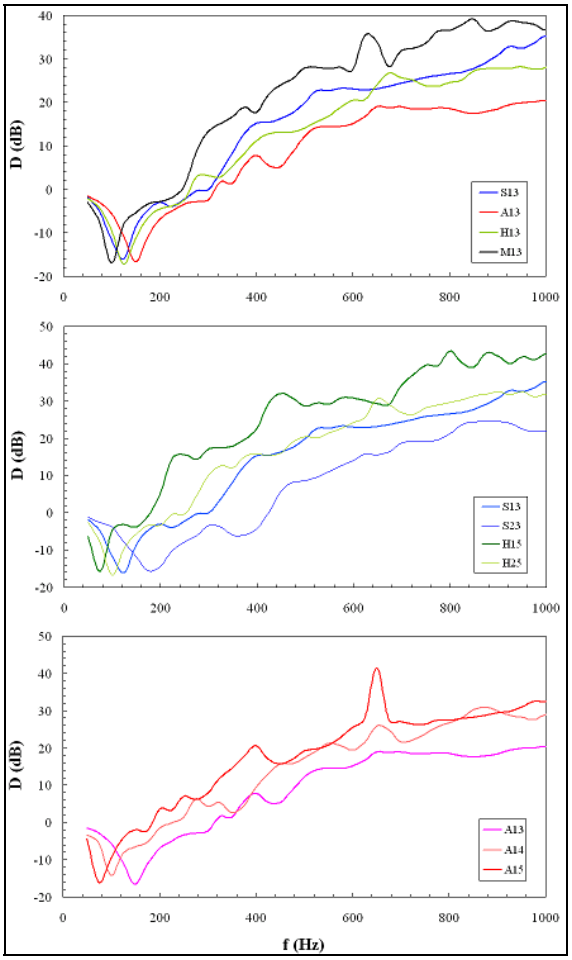

Fig. 3. *Frequency dependencies of the transfer damping function of studied samples.*

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References

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