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Acoustical and Micro-structural Properties of Recycled Grains and Fibres

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This paper presents a systematic study into the production, characterisation and modelling of the acoustic behaviour of highly heterogeneous, low density porous layers having a complex pore size distribution. A new cold extrusion production method was developed at the University of Bradford to process recycled polymeric fibres and grains so that accurate control of the pore size distribution and the porosity of the resultant porous product could be attained. In this way high values of the acoustic absorption coefficient could be obtained in a relatively thin porous layer throughout the design frequency range . Two approaches were used to model the acoustic performance of the manufactured porous media. The first approach requires the direct numerical integration of the Biot viscosity correction function which depends on the probability density function of the pore size. The other approach assumes a low permeability contrast between the two porous scales so that the acoustic properties could be estimated using the semi-phenomenological models of Johnson and Lafarge for the viscous and thermal dynamic permeabilities. Numerical results predicted by the two models were then compared with impedance tube experimental data showing good accuracy of the selected prediction methods.