ACOUSTICS2008/2485
Prediction of ultrasonic noise and attenuation for the simulation of non destructive testing

Frédéric Jenson[a], Vincent Dorval[a] and Gilles Corneloup[b]
[a]CEA-LIST, Centre de Saclay, 9119 Gif-sur-Yvette, France
[b]LCND - Université de la Méditerranée, IUT Aix Provence, Avenue Gaston Berger, 13625 Aix en Provence Cedex, France

Ultrasonic non destructive testing of some polycrystalline materials can be significantly affected by their microstructure. In such materials a fraction of the acoustic energy is redirected in all directions, which leads to both attenuation and structural noise and causes significant loss in detection performances. Consequently, being able to predict these phenomena would help in designing better testing procedures.
During previous works at CEA-LIST, noise and attenuation models have been developped and implemented into the simulation software for non destructive testing CIVA. The noise model describes the microstructure of the material as a set of point-like scatterers and the attenuation model uses a filtering approach. They both require reference ultrasonic measurements to reproduce the behaviour of a given material. The connection of this approach to a scattering model relating noise and attenuation to microstructural characteristics is studied in this work.
The selected model is based on the Born approximation and allows one to relate physical quantities such as the scattering cross section and the attenuation coefficient to second order statistical properties of the microstructure and to elastic properties of a single crystallite. This model accounts for important effects such as anisotropic scattering and mode conversions, but neglects multiple scattering events.
Simulation results obtained with this approach are compared to experimental results.