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Lattice dynamics of the complex metallic alloys o-$Al_{13}Co_4$

Marc De Boissieu[1], Pierre François Lory[2], Marek Mihalkovic[3], Valentina Giordanno[4], Peter Gille[5], Stéphane Pailhes[4], Juri Grin[6], Helmut Schober[7], Mark Johnson[7]

[1]SIMAP, UGA, Cnrs, Saint Martin D'hÈres, France, [2]EPFL, Lausanne, Switzerland, [3]SAS, Bratislava, Slovak Republic, [4]ILM, CNRS, Lyon, France, [5]Ludwig Maxmilian Universitat, Munich, Germany, [6]MPI, Dresden, Germany, [7]ILL, Grenoble, France

E-mail: marc.de-boissieu@simap.grenoble-inp.fr

We present the experimental study of the lattice dynamics of the o-Al13Co4 phase, which is a periodic approximant (about 100 atoms per cell) to a decagonal quasicrystal , using inelastic neutron and x-ray scattering.

Whereas acoustic phonon modes propagating along high symmetry direction are resolution limited, we observe a clear Lorentzian broadening, temperature independent, for those acoustic phonon propagating along low symmetry directions. Those results are fully reproduced by molecular dynamic simulations using oscillating pair potentials only when the partial site occupancy of a few Al atoms is properly taken into account. This illustrates the importance of properly taking into account the chemical disorder, even in structurally complex systems, when physical properties are at play.

We will also present results on the lattice thermal conductivity, simulated using the Green Kubo method. The influence of the chemical disorder on the lattice thermal conductivity will be discussed.

Keywords: quasicrystal approximant, lattice dynamics, disorder