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Electric field gradients in nanoparticles of HfAl₂ and HfAl₃ intermetallic compounds

Perturbed angular correlation (PAC) method was applied to study the electric field gradients in nanopowders of the HfAl₂, HfAl₃ and Hf₂Al₃ intermetallic compounds, obtained via mechanical alloying or after ball milling of the thermally alloyed compound. The influence of the ball milling procedure on the experimentally obtained hyperfine interaction parameters was determined. A strong dependence of the PAC pattern on the milling time was evidenced and attributed to the structural disorder. The thickness of the outer damaged part of the grains depends on the crystallographic structure of the milled material. In HfAl₃ sample, we observed the influence of the milling procedure on the phase transformation. The mechanical alloying process causes serious and stable damage in the powder particle of HfAl₂ sample, these defects cannot be removed by annealing up to 900 C. In the Hf₂Al₃ sample after 60 minutes of milling and subsequent annealing at 700 C, the decomposition of Hf₂Al₃ into two phases HfAl and HfAl₂ was observed. The quadrupole frequency distribution χ increased with decreasing grain size (see Fig. 1.).

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