Mössbauer study of YFe_2Ge_2

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The YFe_2Ge_2 crystallizes isostructural to the AFe_2As_2 (A = Ca, Ba, Eu, K) iron-pnictide parent compounds and superconductors. Superconductivity with T_c = 1.8 K is strongly dependent on the sample quality and disorder caused by Fe atoms deficiency on the Fe site. The coexistence of ferromagnetic and stripe-type antiferromagnetic spin fluctuations within the Fe plane was recently found by neutron scattering. ^{57}Fe Mössbauer spectroscopy measurements were performed versus temperature down to 1.5 K for the YFe_2Ge_2 powdered single-crystal sample grown out of Sn flux. Spectra at room temperature (RT) and 80 K have a shape of broadened pseudo-single line with the quasi-continuous distribution of quadrupole doublets. A distribution is caused by the spatial modulation of the electric field gradient, which can be interpreted as a consequence of the incommensurate modulation of the charge density on the Fe nuclei, i.e., the charge density wave (CDW). The isomer shift at RT is equal to 0.34 mm/s, which is significantly less than 0.43 mm/s for $BaFe_2As_2$. It means that *d*-electrons density is significantly lowered in YFe_2Ge_2 in comparison to non-superconducting parent compound $BaFe_2As_2$. Hence, the system can be considered as strongly hole-doped, similar to KFe_2As_2 superconductor. Spectra at 4.2 K and 1.5 K are significantly broadened due to the spatial modulation of a weak hyperfine magnetic field with the average values about 1.3 and 1.5 Tesla, respectively. The magnetic nature of the spectra close to the ground state can be interpreted as a consequence of the spin fluctuations and indicates that the system is close to magnetic instabilities.

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