POPULATION OF ROTATIONAL BANDS WITH CLUSTER APPROACH

V. Sargsyan, Joint Institute for Nuclear Research, Dubna, Russia

N. Antonenko[1], G. Adamian[1], A. Zubov[1]

1 Joint Institute for Nuclear Research, Dubna,Russia

We studied the population of rotational bands in superheavy nuclei produced in fusion-evaporation reactions ^{206,208}Pb(^{48}Ca,2n)^{252,254}No and ^{204}Hg(^{48}Ca,2n)^{250}Fm. The Fermi-gas model was applied to calculate the level densities. For the description of the capture process, we used the quantum diffusion approach based on the formalism of the reduced density matrix. The interval D = 600–1000 for the damping parameter was found for the description of the damping of the shell effects with the angular momentum and used in the calculations of the relative transition intensities in the ground-state rotational bands and the entry spin distributions of the evaporation residues and the evaporation-residue cross sections for all considered reactions. Angular momentum dependence of these observables mainly comes from the partial capture and survival probabilities. The calculated results are in good agreement with the experimental data. Thus, at low and moderate angular momentum values, the centrifugal forces are not dangerous for the production of superheavy elements, especially in "the island of stability."

Within the cluster approach we studied the population of the yrast SD band in ^{152}Dy, produced in various de-excitation channels of the reactions with different entrance-channel asymmetries. It was shown that the spin population interval of the SD band is restricted from below by the complete fusion process and from above by the quasifission process. The quite good agreement of our results with the experimental data indicates the validity of the cluster interpretation of strongly deformed nuclear states and supports predictions concerning the possible formation of highly deformed states in the entrance channel of heavy-ion reactions (without the compound nucleus formation stage) based on the same theoretical approach.