FUSION BARRIER DISTRIBUTIONS FROM CAPTURE AND QUASI-ELASTIC EXCITATION FUNCTIONS MEASURED IN REACTION ^{36}S, ^{48}Ca, ^{64}Ni+^{238}U

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Abstract

The subbarrier fusion enhancement in reactions with heavy ions were explained by taking into account coupling between relative motion and intrinsic degrees of freedom of interacting nuclei. The coupling of reaction channels manifests itself in the potential barrier between interacting nuclei giving rise to a distribution of fusion barrier instead of single barrier.Capture and quasi-elastic scattering excitation functions at backward angles were measured for ^{36}S, ^{48}Ca, ^{64}Ni+^{238}U reactions systems at energies close and below the Coulomb barrier (i.e. when the influence of the shell effects on the fusion and characteristics of the decay of the composite system is considerable). Representations of the barrier distributions were extracted from both capture and quasi-elastic data. The experimental representations of barrier distributions were compared with coupled-channel calculations using CCFULL code. The major part of these experiments has been performed at the U-400 accelerator of the Flerov Laboratory of Nuclear Reactions (JINR, Dubna); at the TANDEM-ALPI accelerator of the LNL (INFN, Legnaro, Italy) and at the Accelerator Laboratory of University of Jyväskylä (JYFL, Finland) using a time-of-flight spectrometer of fission fragments CORSET (CORrelation SET-up.) The extraction of the masses and Total Kinetic Energy (TKE) of the binary reaction products is based upon the analysis of the two-body velocity In the case of the fusion-fission and quasi-fission processes, the observed peculiarities of mass and energy distributions of the fragments, the ratio between the fusion-fission and quasi-fission cross sections are determined deformations of interaction nuclei and angular momentum carried in the di-nuclear system and the shell structure of the formed fragments.

In this work, the high-precision capture and quasi-elastic scattering excitation function data are presented.The influence of projectile and target excitations and nucleon transfer on fusion barrier distribution in this system is discussed. Experimentally obtained barrier distributions have been used to reveal the role of nuclear deformation, vibrational excitation and nucleon transfer in fusion process.