ABSTRACT

Isospin Equilibration in the Reaction

$^{40}\text{Ar}, \ ^{40}\text{Ca} + \ ^{58}\text{Fe}, \ ^{58}\text{Ni}$ E/A = 33, 45 MeV. (December 1996)

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Beams from the K-500 superconducting cyclotron were used in experiments with the neutron ball to explore the equilibration of the N/Z degree of freedom in the reactions $^{40}\text{Ca}, \ ^{40}\text{Ar} + \ ^{58}\text{Fe}, \ ^{58}\text{Ni}$ at E/A = 33 and 45 MeV. By utilizing detectors capable of collecting charged particles and the neutron multiplicity information provided by the neutron ball, the disassembly of the reacting system was reconstructed. These experiments determined to what extent the isospin degree of freedom equilibrates at two different energies for the same compound system. At E/A = 33 MeV, the system behaves as if it is equilibrated prior to the emission of reaction products, while at E/A = 45 MeV the same composite system results in different isobaric ratios depending on the initial projectile and target; therefore, the emission of reaction products occurs prior to complete equilibration.

Comparisons to model calculations find that QMD (Quantum Molecular Dynamics) reproduces $^7\text{Li}$ energy spectra at low energies, the charge distributions from 6° to 76°, and the $^{10}\text{Be}/^{10}\text{B}$ isobaric ratios at E/A = 33 MeV. Except for the 40° charge distribution, BUU (Boltzmann-Uehling-Uhlenbeck) residues input into GEMINI fail to reproduce the experimental results. In addition, both codes fail to predict the experimentally observed non-equilibration at 45 MeV.