Multinucleon Transfer and Incomplete Fusion at 15 MeV/nucleon for the ^{86}Kr + ^{27}Al System

K. Gkatzogias[1], G.A. Souliotis[1], Ch. Giannitsa[1], S. Koulouris[1], A. Pakou[2], M. Veselsky[3], S.J. Yennello[4], A. Bonasera[4]

[1] *Laboratory of Physical Chemistry, Department of Chemistry, National and Kapodistrian University of Athens, Athens 157 71, Greece*

[2] *Department of Physics, The University of Ioannina, 451 10, Ioannina, Greece*

[3] *Institute of Experimental and Applied Physics, Czech Technical University, Prague 110 00, Czech Republic*

[4] *Cyclotron Institute, Texas A&M University, College Station, Texas 77843, USA*

Presenting author email: gkakonst@chem.uoa.gr

We present an investigation of the mass-asymmetric collision of a ^{86}Kr beam with a ^{27}Al target at an incident energy of 15 MeV/nucleon. The primary goal is to characterize the mass, angular, and momentum distributions of projectile-like fragments emerging from this reaction. The experimental data utilized here were acquired with the MARS spectrometer at the Texas A&M University Cyclotron Institute during earlier work by our group [1]. These data are compared with theoretical predictions from two approaches: the phenomenological Deep-Inelastic Transfer (DIT) model, that describes the reaction dynamics, [2] and the microscopic Constrained Molecular Dynamics (CoMD) model [3]. In both cases, the statistical decay code GEMINI [4] is employed to describe the de-excitation of primary fragments. A comparison between the measured observables and the model outcomes offers meaningful insight into the contributing reaction mechanisms. The DIT model successfully captures the multinucleon transfer (MNT) processes. The CoMD model, while also reproducing the MNT features, additionally accounts for an incomplete fusion component in this light target. It is worth noting that the MNT mechanism is responsible for generating neutron-rich nuclides in this mass region [5–9]. We anticipate that the study of this mass-asymmetric system will enhance our understanding of heavy-ion reaction mechanisms below the Fermi energy regime (15–35 MeV/nucleon).

References

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