Fusion hindrance in the ^{48}Ca+^{154}Sm reaction

M. Trotta[1], A.M. Stefanini[1], B. Behera[1], L. Corradi[1], E. Fioretto[1], A. Gadea[1], S. Szilner[1], Y.W. Wu[1], S. Beghini[2], G. Montagnoli[2], F. Scarlassara[2], A.Yu. Chizhov[3], G.N. Kniajeva[3], E.M. Kozulin[3], N.A. Kondratiev[3], I.V. Pokrovskij[3], R.N. Sagaidak[3], V.M. Voskresenskij[3], F. Haas[4], N. Rowley[4]

[1] *INFN-Laboratori Nazionali di Legnaro, I-35020 Legnaro, Padova, Italy,* [2] *Universitá di Padova, and INFN-Sezione di Padova, Italy,* [3] *FLNR, JINR, Dubna, Russia,* [4] *IReS, F-67037, Strasbourg, France*

Understanding the mechanism of competition between fusion-fission and fusion-evaporation is important also in connection with the possibility of establishing which are the most favourable reactions for producing super-heavy elements. Fusion-evaporation and fusion-fission cross sections have been simultaneously measured for ^{48}Ca+^{154}Sm near the Coulomb barrier using ^{48}Ca beams produced by the XTU-Tandem accelerator of LNL. ER were detected using an electrostatic deflector followed by an Energy-ToF telescope, and FF were mass identified by the two-arm ToF spectrometer CORSET developed in Dubna. ER total cross sections for ^{48}Ca+^{154}Sm have been extracted and compared to ^{16}O+^{186}W fusion-evaporation data [1]. Both entrance channels lead to the compound nucleus ^{202}Pb and are expected [2] to give the same reduced cross sections $\sigma_{ER}/\pi\lambda^2$ at sufficiently high excitation energies where the transmission coefficient $T_\ell \approx 1$ for all partial waves leading to ER, as long as no system-dependent fusion hindrance exists. The reduced ER experimental cross sections (points) are presented vs. excitation energy in Fig. 1, where one can see that fusion seems to be suppressed by almost 40% above $E_{exc} \approx 60$ MeV for the ^{48}Ca induced reaction. This result is consistent with the quasi-fission component observed for this reaction at all energies. Statistical model calculations (lines in Fig. 1) show that indeed reduced cross sections should merge for $E_{exc} \geq 80$ MeV, so in order to draw clear-cut conclusions about the fusion hindrance effect, data at higher excitation energies are needed for both ^{48}Ca+^{154}Sm and ^{16}O+^{186}W. Such measurements have been performed quite recently and data analysis is in progress.

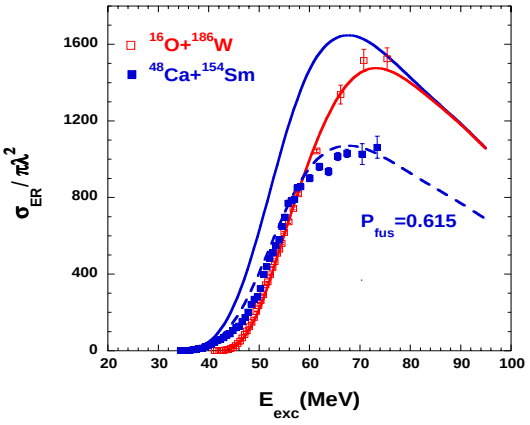

Figure 1: Reduced ER experimental cross sections (points) compared to HIVAP calculations (lines) for ^{48}Ca+^{154}Sm and ^{16}O+^{186}W.

[1] J.R. Leigh et al., Phys. Rev. C52, 3151 (1995)

[2] A.C. Berriman et al., Nature 413, 144 (2001)