INFLUENCE OF PROJECTILE NEUTRON NUMBER ON CROSS SECTION IN COLD FUSION REACTIONS

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Elements 107- 112 [1,2] have been discovered in reactions between ^{208}Pb or ^{209}Bi targets and projectiles ranging from ^{54}Cr through ^{70}Zn. In such reactions, the compound nucleus can be formed at excitation energies as low as ~12 MeV, thus this type of reaction has been referred to as "cold fusion." The study of cold fusion reactions is an indispensable approach to gaining a better understanding of heavy element formation and decay. A theoretical model that successfully predicts not only the magnitudes of cold fusion cross sections, but also the shapes of excitation functions and the cross section ratios between various reaction pairs was recently developed by Świątecki, Siwek-Wilczyńska, and Wilczyński [3,4]. This theoretical model, also referred to as *Fusion by Diffusion,* has been the guide in all of our cold fusion studies. One particularly interesting aspect of this model is the large predicted difference in cross sections between projectiles differing by two neutrons. The projectile pair where this difference is predicted to be largest is ^{48}Ti and ^{50}Ti. To test and extend this model, ^{208}Pb(^{48}Ti,*n*)^{255}Rf and ^{208}Pb(^{50}Ti,*n*)^{257}Rf excitation functions were recently measured at the Lawrence Berkeley National Laboratory's (LBNL) 88-Inch Cyclotron utilizing the Berkeley Gas-filled Separator (BGS). The ^{50}Ti reaction was carried out with thin lead targets (~100μg/cm^2), and the ^{48}Ti reaction with both thin and thick targets (~470 μg/cm^2). In addition to this reaction pair, reactions with projectile pairs ^{52}Cr and ^{54}Cr [5], ^{56}Fe and ^{58}Fe [6], and ^{62}Ni and ^{64}Ni [8] will be discussed and compared to the *Fusion by Diffusion* predictions. The model predictions show a very good agreement with the data.

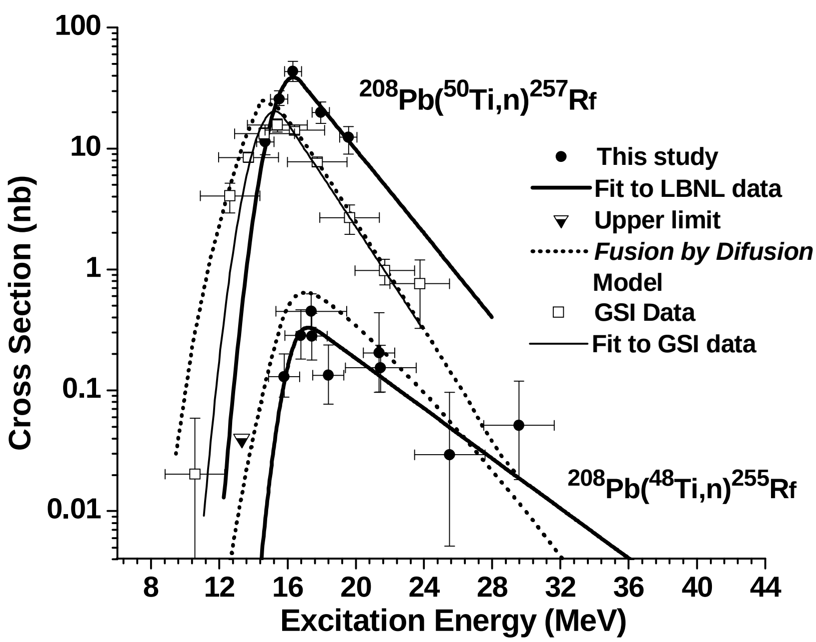

Figure 1: *^{208}Pb (^{50}Ti, n) ^{257}Rf and ^{208}Pb (^{48}Ti, n) ^{255}Rf excitation functions are shown. Filled circles are LBNL data, and open squares represent GSI data [9]. Fits to data are obtained by using a Gaussian on the low energy side, smoothly joined to an exponential on the high energy side. Horizontal bars represent energy width due to target thickness. The dotted lines are predictions from the Fusion by Diffusion model.*

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