Elastic scattering angular distribution in the ^{11}B + ^{232}Th reaction

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Introduction

Elastic scattering provide the knowledge about the optical potential parameters. These optical potential parameters are real and imaginary. Real and imaginary optical potential parameters related to each other and consistent with dispersion relation. It is established evidence that the near Coulomb barrier elastic scattering of tightly bound heavy ions display an energy dependence of the interacting optical potential known as a threshold anomaly (TA) [1]. This additional attraction of the real potential decreases the Coulomb barrier, consequently enhancing the fusion cross-section, when compared with no-coupling calculations. This phenomenon has been named threshold anomaly (TA). A characteristic localized peak in the real part and the corresponding decrease of the imaginary part of the potential are observed as the bombarding energy decreases towards the Coulomb barrier. This has been understood in terms of couplings of elastic channel to the direct reaction channels that generate an additional attractive real dynamic polarization potential. In an earlier work, it has been observed that in heavy ion induced reactions, the projectile structure plays an important role [2]. Particularly, in case of scattering of loosely bound projectiles a different type energy dependence from that of TA is observed, which has been known as `breakup threshold anomaly' (BTA). In case of BTA, a repulsive real dynamical potential is generated due to couplings of breakup channels to the elastic scattering.

There are very limited elastic scattering data for ^{10}B and ^{11}B projectiles with heavy targets and so far measurements reported for $^{10,11}B$ + ^{232}Th systems [3]. In the present work, we have analyzed the elastic scattering angular distribution data for ^{11}B + ^{232}Th system using Sao Paulo Potential.

The total reaction cross sections for ^{11}B + ^{232}Th system have also been derived in order to investigate the effect of breakup on the total reaction cross section.

Results and discussion:

The experimental elastic scattering angular distribution data has been analysed by using Sao Paulo Potential [4,5]. In the fitting procedure used only two free parameters, N_r and N_i the energy-dependent normalization coefficients. The resulting fits of the normalization parameters are listed in Tables I for ^{11}B + ^{232}Th. The best fitted optical model parameters show significant energy dependence as reflected from Table-I.

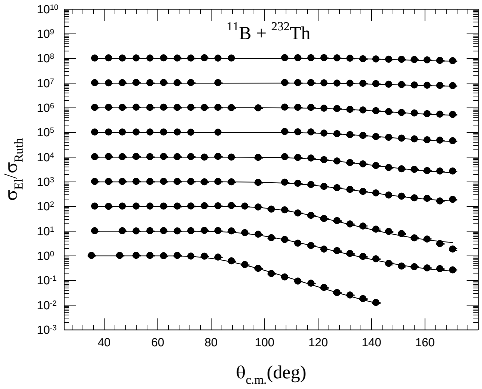

Fig.2: Elastic scattering angular distribution for the ^{11}B + ^{232}Th system at different beam energies. Data analyzing by SPP code.

In the present work, the total reaction cross sections derived from the SPP calculation for ^{11}B + ^{232}Th systems compared with previous analysis, as shown in the table. It is observed that the reaction cross sections are consistent with the energy [3,6]. The curves resulting from the best fits shown in Fig 1.

The optical model analysis of elastic scattering angular-distribution data has been carried out to extract the optical potential parameters and reaction cross sections for all energies of ^{11}B + ^{232}Th systems. N_r and N_i take into account the effects of the dynamical polarization potential due to direct channel couplings.

Over all, very good fits to the experimental elastic scattering data were obtained at all near barrier energies as shown in the figure. This significant energy dependence is a characteristic feature of the elastic scattering. More detailed analysis being carried out and the results will be presented in the symposium.

TABLE-I: Optical model parameters obtained by fitting to experimental elastic differential cross section data using the SPP code in ^{11}B + ^{232}Th reaction. The reaction cross section in the column (5) [take from [Reff.3]] presented here for the comparison with present work.

Energy(MeV)	N_r	N_i	σ_R (mb)	σ_R (mb) [Reff. 3]	$\chi^2/2$
65	0.216	0.709	883.70	886.42	11.78
61	0.313	0.567	595.74	601.70	11.08
59	0.536	0.388	432.42	432.61	4.760
57	0.481	0.364	275.90	279.72	4.550
56	0.579	0.321	209.43	216.21	2.470
55	0.620	0.173	103.78	105.40	3.530
54	0.739	0.204	89.650	89.74	0.940
53	0.712	0.089	27.800	29.81	0.510
52	1.076	0.059	9.3700	7.02	0.260

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