α inelastic scattering cross sections on ^{12}C with microscopic coupled-channel calculation

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Cluster states near the threshold energy have been investigated from astrophysical interest. The α inelastic scattering can be a good tool to search for new cluster states [1-3]. For ^{12}C, not only the 0_2^+ state but also other cluster states have been suggested to give some effect to the reaction rate. The 2_2^+ state has been newly discovered by the (α, α') reaction [3], but its properties have not been clarified yet. In the theoretical description of the (α, α') reaction, a severe overshooting problem of the cross section to the 0_2^+ state, which is called "missing monopole strength", has been discussed for years [4]. Recently, the g-matrix folding model has been applied by Minomo and Ogata using the RGM transition density, and succeeded to reproduce the 0_2^+ cross sections [5].

In this paper, we investigate the α inelastic scattering on ^{12}C with the coupled-channel calculation using the α-nucleus optical potentials, which were microscopically derived by folding the the Melbourne g-matrix NN interaction with the densities of ^{12}C. We adopt the matter and transition densities of ^{12}C obtained by a microscopic structure model of the antisymmetrized molecular dynamics (AMD) combined with and without the 3α generator coordinate method (GCM). The calculations reproduce the observe elastic and inelastic cross sections at incident energies of $E_\alpha = 130$ MeV, 172.5 MeV, 240 MeV, and 386 MeV. The cross sections to the 0_2^+, 0_3^+, 2_2^+, and 1_1^- states are discussed.

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