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Modified Single-Folded Potentials for the Alpha-^{24}Mg and Alpha-^{28}Si Elastic Scattering

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Abstract : Alpha-nucleus interaction is obscured because it produces enhanced cross-sections at large scattering angles known as anomaly in large angle scattering (ALAS). ALAS is prominent in the elastic scattering of α-particles as well as in non-elastic processes involving α-particles for incident energies up to 50 MeV and for targets of mass A ≤ 50. The Woods-Saxon type of optical model potential fails to describe the processes in a consistent manner. Folded potential is a good candidate and often used to construct the potential which is derived from the microscopic as well as semi-microscopic folding calculations. The present work reports the analyses of the elastic scattering of α-particles from ^{24}Mg and ^{28}Si at Eα=22-100 MeV and 14.4-120 MeV incident energies respectively in terms of the modified single-folded (MSF) potential. To derive the MSF potential, we take the view that the nucleons in the target nuclei ^{24}Mg and ^{28}Si are primarily in α-like clusters and the rest of the time in unclustered nucleonic configuration. The MSF potential, found in this study, does not need any renormalization over the whole range of incident α energies, and the renormalization factor has been found to be exactly 1 for both the targets. The best-fit parameters yield 4Aα = 21 and AN = 3 for α-^{24}Mg potential, and 4Aα = 26 and AN = 2 for α-^{28}Si potential in time-average pictures. The root-mean-square radii of both ^{24}Mg and ^{28}Si are also deduced, and the results obtained from this work agree well with the outcomes of other studies.

Keywords : elastic scattering, optical model, folded potential, renormalization
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