Influence of Effective Surface Property on Nuclear Structure within Coherent Density Fluctuation Model

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A systematic study of symmetry energy $S_{\rm sym}(\rho)$, neutron pressure, and, symmetry energy curvature collective known as effective surface property of $N = 40$ isotonic series (from $Z = 16$ to $Z = 46$) has been studied within the Coherent Density Fluctuation Model (CDFM). The density dependent symmetry energy can be yielded from the density distribution of finite nuclei. These densities are obtained from the Relativistic Mean Field Model using different sets of parameters like NL3 and IOPB-I. The equation of state of asymmetric nuclear matter is limited due to the undetermined symmetry energy and lack of initial constraint on the nuclear matter leading to the study of the nuclear matter symmetry energy with finite nuclei properties. We have also calculated the bulk properties of the ground state, including pairing energy, binding energy, and two neutron separation energy to support our findings, which are in good agreement with work done by R. Sharma et al. The effective surface properties show the change of behavior at $N = 20, 28, 40$ which validates the shell closure properties/magic behavior. We have also witnessed that the skin-thickness cor- related with the symmetry energy for the same isotonic series. The symmetry energy of $N = 40$ is found to be correlated with nuclear structure properties. This study will help in the production of neutron-rich nuclei and also the constraints of heavy ion reactions.