Volume and Surface Components of the Nuclear Symmetry Energy

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The Coherent Density Fluctuation Model (CDFM) (e.g., [1]) is used to calculate the volume (a_A^V) and surface (a_A^S) contributions (and their ratio) to the nuclear symmetry energy (NSE). Starting with global values of parameters for infinite nuclear matter, our approach makes it possible to derive their corresponding values in finite nuclei. Two energy-density functionals for nuclear matter, those of Brueckner [2] and Skyrme (e.g., [3]) are used. The former one has been applied in our previous works [4] to estimate the NSE in finite nuclei and these results are used in the present work. The weight function in the CDFM is obtained using the proton and neutron densities from the self-consistent HF+BCS method with Skyrme interactions. The obtained values of a_A^V, a_A^S, and their ratio for the Ni, Sn, and Pb isotopic chains and their isotopic sensitivity are presented and discussed. The results are compared with those of other theoretical methods, as well as with available experimental data obtained from analyses of nuclear properties, such as binding energies, neutron-skin thicknesses, excitation energies to isobaric analog states and others.

References

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