Temperature dependence of the symmetry energy components for finite nuclei

A. N. Antonov¹, D. N. Kadrev¹, M. K. Gaidarov¹, P. Sarriguren², E. Moya de Guerra³

¹Institute for Nuclear Research and Nuclear Energy, Bulgarian Academy of Sciences, Sofia 1784, Bulgaria
²Instituto de Estructura de la Materia, IEM-CSIC, Serrano 123, E-28006 Madrid, Spain
³Departamento de Fisica Atomica, Molecular y Nuclear, Facultad de Ciencias Fisicas, Universidad Complutense de Madrid, E-28040 Madrid, Spain

E-mail: gaidarov@inrne.bas.bg

Abstract. We investigate the temperature dependence of the volume and surface components of the nuclear symmetry energy (NSE) and their ratio [1] in the framework of the local density approximation. The results of these quantities for finite nuclei are obtained within the coherent density fluctuation model (CDFM) [2, 3]. The CDFM weight function is obtained using the temperature-dependent proton and neutron densities calculated through the HFBTHO code that solves the nuclear Skyrme-Hartree-Fock-Bogoliubov problem by using the cylindrical transformed deformed harmonic-oscillator basis [4]. We present and discuss the values of the volume and surface contributions to the NSE and their ratio obtained for the Ni, Sn, and Pb isotopic chains around double-magic ⁷⁸Ni, ¹³²Sn, and ²⁰⁸Pb nuclei. The results for the T-dependence of the considered quantities are compared with estimations made previously for zero temperature [5] showing the behavior of the NSE components and their ratio, as well as with the available experimental data. The sensitivity of the results on various forms of the density dependence of the symmetry energy is studied. We confirm the existence of “kinks” of these quantities as functions of the mass number at T = 0 MeV for the double closed-shell nuclei ⁷⁸Ni and ¹³²Sn and the lack of “kinks” for the Pb isotopes, as well as the disappearance of these kinks as the temperature increases.

References