The problem of wide range equations of state remains unsolved nowadays. The most relevant models, such as DFT approaches, have computational difficulties and restrictions for the temperatures of the order 10 eV and for the low densities. However, a reliable equation of state for the warm dense matter is possible to obtain with simplified approaches such as semiclassical average atom model.

The semiclassical approach [1] for the calculation of thermodynamic functions of electrons has been developed to extend the region of validity [2] of the Thomas-Fermi model at finite temperatures. The calculation of the shell correction here is of high importance because it provides thermodynamic functions with the information about bound states of electrons which is necessary for the step-wise inoization [3].

The method for calculating the shell correction, which was firstly proposed by G. V. Shpatakovskaya, has been essentially modified by the authors. Multiplicity of assumptions used earlier was too difficult to check numerically. Modern numerical algorithms applied at powerful computers allowed us to eliminate these disadvantages and enhance the precision.