

Study of Alpha-Decay Half–Life Time Using Analytical Formula

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ABSTRACT

In the framework of the preformed-cluster model, a simple method for calculating α -decay half-lives ($T_{1/2}$) of even-even nuclei in the range $Z_p=90-122$ and $N_p=112-190$ is derived using the WKB approximation. Then, the neutron number variation of both $\log(T_{1/2})$ and the reciprocal of α -decay energy ($1/Q_\alpha$) are studied to explore nucleon magic numbers. The study shows that the shell effect plays an important role in α -decay half-lives and α -decay energies. That is, the closer the nucleon number of daughter nuclei to a magic number, the smaller the values of both $\log(T_{1/2})$ and $(1/Q_\alpha)$ of the parent nucleus. As a result, the predicted neutron and proton magic numbers are $N=126, 162, 178$ and 184 and $Z=108, 114, 118$ and 120 , respectively, which are found in agreement with those predicted in other studies.

Keywords: α -decay, Superheavy nuclei, Half-life, α -decay energy.