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Insight into α clustering of proton-rich nuclei via their α decay[1]

YIBIN QIAN, Nanjing University of Science and Technology — We focus on the α clustering phenomenon of proton-rich nuclei in terms of the preformation probability of α cluster before its penetration. Through the experimental decay data, the α preformation factor P_α is extracted for a large range of nuclei in the neutron-deficient region. It is found that the present α preformation factor varies more smoothly towards the large neutron-proton ratio, as compared to those from the previous evaluations. This may come from the separate consideration of proton and neutron density distributions of related nuclei, while they are treated as the same form before. The similarity between the P_α value and the pairing gap is clearly demonstrated, indicating the crucial role of pairing correlation involved in the α decay process. As a further step, the correlation between the α preformation factor and the microscopic correction of nuclear mass, corresponding to the effect of shell and pairing plus deformation, is in particular investigated to pursue the valuable knowledge of P_α pattern over the nuclide chart. Owing to this, the systematical results on lifetimes of α emitters are obviously improved within the transfer matrix method.

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