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Total kinetic energy distributions for spontaneous fission of rutherfordium isotopes

Spontaneous fission (SF) is a decay mode with significant impact on the stability of nuclei in the trans-fermium region. These isotopes are mainly stabilized by microscopic effects [1]. Systematic studies of SF properties allow us to understand these effects and to determine production possibilities for the heaviest nuclei. Interesting phenomenon in some SF nuclei is the existence of bimodal fission, i.e. the co-existence of two fission modes. Previous studies confirmed this concept in Fm, No and Md isotopes ($Z = 100, 101$ and 102) [2, 3]. Theoretical calculations discuss the possibility of bimodal fission for even-even $^{254-260}\text{Rf}$ isotopes, which should be noticeable on the fragments mass distributions as well as on the total kinetic energy (TKE) distributions [4]. However, only a limited statistics of SF events with measured TKE were experimentally obtained for Rf ($Z=104$) isotopes [2, 3, 5].

We performed detailed SF study of $^{255,256,258}\text{Rf}$ at the velocity filter SHIP in GSI Darmstadt. System of Si detectors for TKE measurements was applied. The crucial task for such evaluation is the correction of deficit in measured energies due to the pulse-height defect [6, 7]. We successfully determined the energy correction in measurements of ^{252}No with well-known TKE [3]. Comparison of our and previous results on mean TKE of ^{258}Rf confirmed the validity of the correction method. New results on TKE distributions of $^{255,256}\text{Rf}$ with significantly improved data quality were obtained, allowing us to search for bimodal fission and to evaluate the mean TKE of these isotopes.

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