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Understanding of Decay Heat and the Reactor Anti-neutrino Spectrum Using Total Absorption Spectroscopy

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Total Absorption Spectroscopy is a unique technique characterized by high efficiency detection of gamma-ray radiation. This property, used in the study of beta decay of unstable nuclei, allows for the total detection of the deexcitation path of daughter nuclei. This makes it an ideal technique to establish the true beta-decay feeding pattern, especially for the decays of nuclei suffering from the Pandemonium Effect [1]. Recent studies show that the measurements of fission products by total absorption spectroscopy are extremely important to understanding the decay heat and anti-neutrino spectrum emitted from nuclear reactors [2].

Decay heat is determined on the basis of the average energy of gamma and beta radiation emitted in the beta decay of fission products. Incomplete knowledge of the decay schemes, in particular, omission of beta transitions to high-excited states, causes an underestimation of the electromagnetic part of the decay heat and a revaluation of the beta component. This was observed by comparison with direct measurements[3]. The solution is to measure the beta decay of fission products using high-efficiency systems such as total absorption spectrometers.

The number of reactor anti-neutrino interactions measured by inverse-beta decay detectors is about 6% smaller than the expected number of events, which is named the reactor anti-neutrino anomaly [4]. The anti-neutrino energy spectrum, obtained from the fission product beta-decay schemes, is used to calculate the total anti-neutrino flux emitted by reactor cores and the number of anti-neutrino interactions with the detector matter. The measurements of the beta decay of fission products using the total absorption technique allow verification of the expected number of interacting reactor anti-neutrinos with matter.

In this contribution we present several results of total absorption spectroscopy measurements of the beta decay of nuclides abundantly produced in the reactor core. The measurements were performed at the Holifield Radioactive Ion Beam Facility (HRIBF) with the Modular Total Absorption Spectrometer (MTAS), the largest total absorption spectrometer in the world. The results and their impact on the decay heat and anti-neutrino spectra reconstruction will be presented and discussed.

References:

1. J. Hardy et al., Phys. Lett. B71, 307, 1977
2. BC. Rasco et al., PRL 117, 092501, 2016
3. T. Yoshida et al., OECD report, NEA, 2007
4. G. Mention et al., PRD 83, 073006, 2011

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