Advances of Accelerator Technology Development for Nuclear Transmutation in the ImPACT Program

(3) Study of MERIT (Multiplex Energy Recovery Internal Target) on Intense Negative Muon Production for Muon Nuclear Transmutation

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Abstract (approx. 55words)

An intense negative muon source for muon nuclear transformation based on MERIT (multiplex energy recovery internal target) ring has been developed to mitigate the long lived fission products of nuclear wastes. The present status of MERIT development and advanced MERIT scheme with deuteron beam are presented.

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Keywords: LLFP, ERIT, nuclear transmutation, muon

1. Introduction

In the ImPACT project, various studies and developments aiming to mitigate and even re-use the nuclear wastes, especially long lived fission products (LLFPs) have been carried out. In muonic atom, the atomic nucleus absorbs a negative muon with large probability (95per cent), if the atomic number (Z) is more than 30 and then, it transforms to a stable nucleus by beta decay and the emission of several neutrons. The key issue of this scheme is muon production. To make it in reality, at least the negative muon intensity of more than 10^{16} μ^-/sec is necessary. For this purpose we have proposed a MERIT scheme.

2. MERIT scheme for muon production

In order to produce an intense secondary particles such as neutron efficiently, a scheme of ERIT(Energy Recovery Internal Target) has been developed [1]. For intense negative muon production, because of relatively high primary beam energy, the acceleration and storage with energy recovering are essential. Thus, an advanced scheme of ERIT, named MERIT (Multiplex Energy Recovery Internal Target) wad proposed[2] and the proof of principle development has been carried out. Recently, we succeeded in beam acceleration with a preliminary experiment. To generate negative muons efficiently, deuterons looks better than protons as primary particles because deuteron consists of neutron. A new scheme of MERIT with deuteron beam and deuterium gas target filled in the ring has been also proposed[3].

3. Conclusion

A new scheme with multiplex energy recovery internal target (MERIT) has been proposed for efficient production of negative muons to mitigate the long-lived fission products in the nuclear wastes from the nuclear power plant with muon nuclear transformation. The present status of the proof of principle development and also a new scheme with deuteron beam and deuterium gas target are presented.

References

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