Report 019

The Americium - Beryllium synergy for energy production and radioactive waste treatment

Neutron gun at OpenShareLab

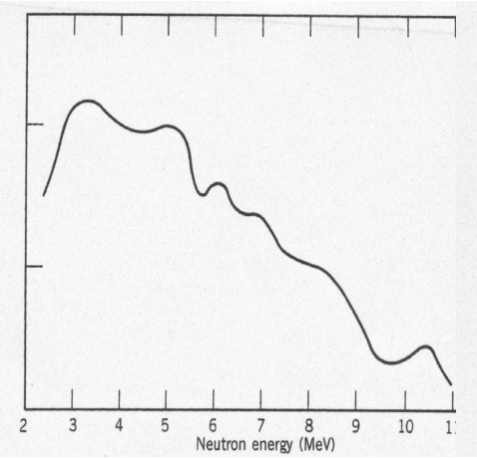
Americium 241 is a well known α-emitter, at the energy level of about 5.5 MeV, and one among the major components of radioactive wastes from conventional nuclear plants.

Beryllium 9, the only stable isotope, has a loosely bound neutron (1.66 MeV)

$$M(^{8}\mathrm{Be}) + M_n - M(^{9}\mathrm{Be}) = 1.665\ \mathrm{MeV}$$

that can be expelled at the americium α emission energy, according to the reaction

$$\alpha + {}^{9}\mathrm{Be} \longrightarrow {}^{12}\mathrm{C} + \mathrm{n} + 5.7\ \mathrm{MeV}\ .$$



Tipical neutron emission spectrum from Beryllium

The americium - beryllium synergy is thus known in the sector of neutron production for medical and laboratory employ.

Often the two elements are mixed in powder form, as oxides. They are chemically stable under a large temperature range.

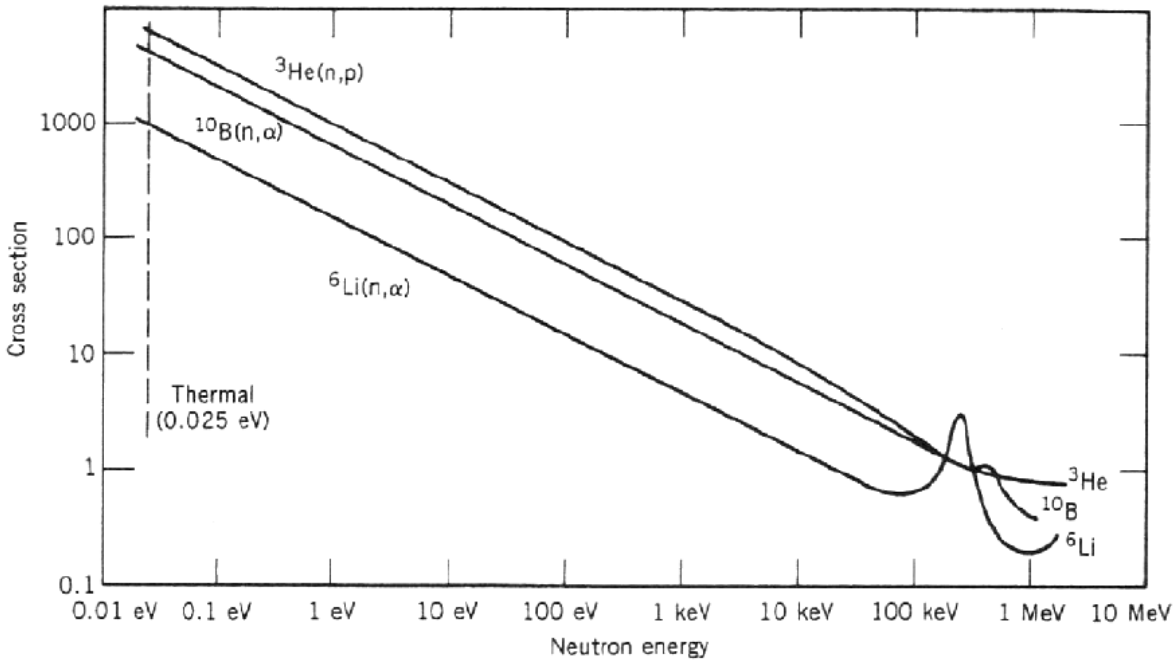
At the ***Open Power Lab*** is under study the characterization of neutrons emitted by the joint presence of a very small quantity of americium 241 (like that contained in a smoke detector) and a small “Beryl” crystal (semiprecious stone, beryllium aluminum silicate).

Americium tablet and “Heliodor” Beryl

The purpose is to draw the energy spectrum of emitted neutrons, with the aim of evaluating the usefulness of introducing the americium-beryllium mixture into the fuel composition, specially when in the presence of thermal neutron catchers like lithium 6 and boron 10, according to the exothermal reactions:

$$^{6}Li + n \rightarrow {}^{3}H + \alpha + 4.78\ MeV$$

$$^{10}_{5}B + {}^{1}_{0}n \rightarrow {}^{7}_{3}Li' + \alpha + 2.310\ MeV$$



Cross-sections for neutron capture

The suggested hypothesis would employ a radioactive waste like americium, revaluing its importance (in synergy with beryllium) for ***energy production*** , underlining also their capability for ***radioactive elements stabilization***, by neutron bombardment, in a safe way owing to the α radiation is easily shieldable and the neutrons resulting from synergy , as slow, would be locally absorbed by the lithium - boron dispersed in the fuel mixture, or respectively by the radioactive nuclei in the target to cut down.

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