Lattice Confinement Nuclear Fusions Using Photon Showered Erbium: Another Kind of Room Temperature Fusion Discovery in NASA's Glenn Research Center

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1. Introduction

Another kind of room temperature fusion is investigated at NASA's Glenn research center for seeking energy sources applicable in the deep-space journeys and eventually the building of the new colonies [1-3]. Fig. 1 shows the feature of Erbium where the lattice is the hexagonal closed packed (HCP) structure [4]. The low energy nuclear reactions (LENRs) are described in this work where the Erbium is a major element to design the LENRs reaction where the nuclear fusion could be realized with the excess heat productions.

2. Methods

In the modeling, the experiment is considered by nuclear fusion or Oppenheimer-Phillips (O-P) nuclear stripping reactions which his is in Fig. 2 that shows the scheme of NASA's experiment. The deuterated material (ErD_3) is showered by the photons with 2.5 to 2.9 MeV where the 2.45 MeV neutrons is consistent with $^2H(d,n)^3He$ fusion reactions [5]. It is proposed that the experimental fusion cross section $\sigma_{exp}(E)$ is [5],

$$\sigma_{exp}(E) = \sigma_{bare}(E) f(E) \quad (1)$$

where $f(E)$ is the enhancement factor. So,

$$f(E) = \frac{S(E+U_e)}{S(E)} \frac{E}{(E+U_e)} exp[G(E) - G(E+U_e)] \quad (2)$$

There is the animation that describes the reaction [6]. In this work, the simulations are performed for the possibility of the experiment. Fig. 3 has the SRIM simulations with the set-up for simulation of 10keV deuterons into Erbium of thickness 10^4 Angstrom [7]. The ion trajectories of 500keV deuterons into Erbium (side view) and the ion trajectories of 500keV deuterons into Erbium (transverse view). The result gives the ion ranges of 10keV deuterons into Erbium.

In the simulations, there are some significant features. The Ion Range is obtained as the unit of $(atoms/cm^3)/(atoms/cm^2)$. Ionization is described as Energy Loss (eV/Angstrom). The Collision Events is shown as Number/(Angstrom-Ion).

3. Results

In this work, in case of Fig. 3(d), the value is obtained by the target thickness in the most probable point. The slope decreases rapidly until 100 keV. Fig. 4 describes the related events for the most probable point. Table 1 is the list of events.

4. Conclusions

Fig. 5 shows the meaning of LENRs where another kind of energy production could be possible using the room temperature reactions to be commercialized in the space as well as industry.

Acknowledgements

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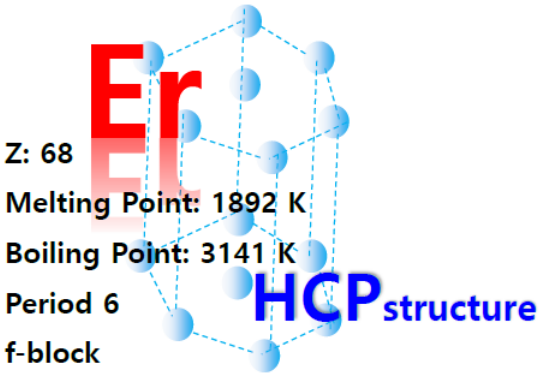


Fig. 1. Feature of Erbium.

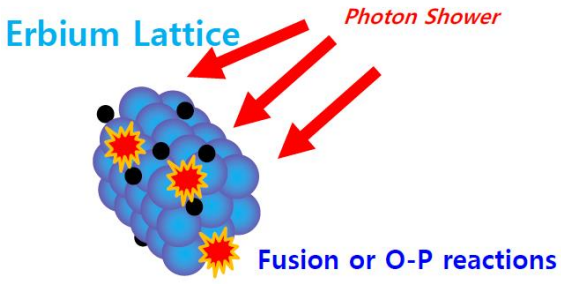
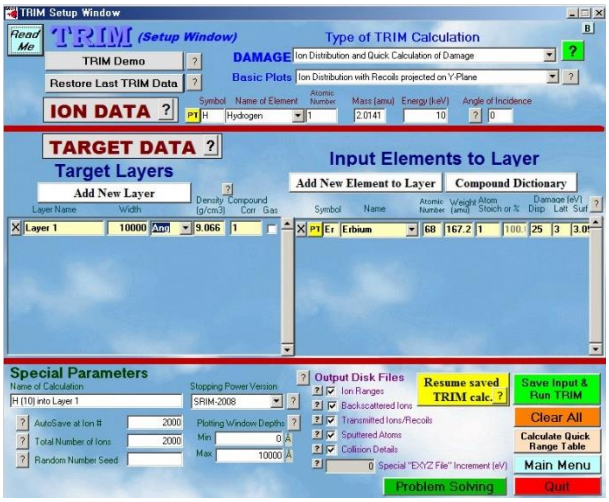
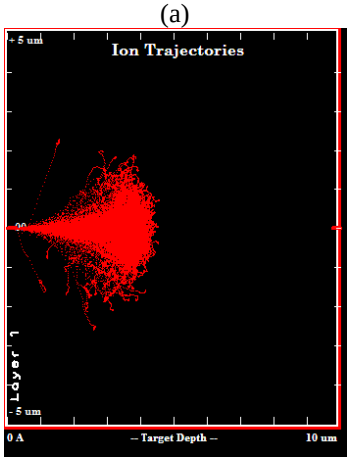


Fig. 2. Scheme of NASA's experiment.



(a)



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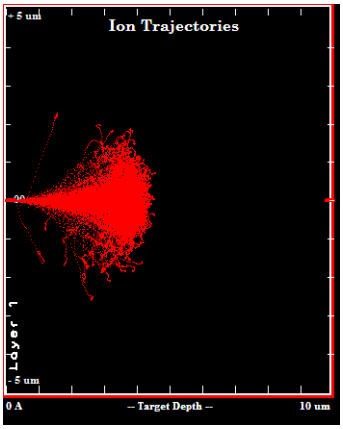

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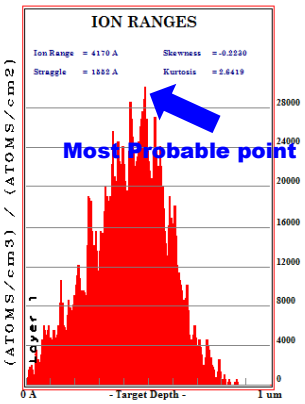

(d)

Fig. 3. SRIM simulations (a) Set-up for simulation of 10keV deuterons into Erbium of thickness 10^4 Angstrom (b) Ion trajectories of 500keV deuterons into Erbium (side view) (c) Ion trajectories of 500keV deuterons into Erbium (transverse view) (d) Ion ranges of 10keV deuterons into Erbium.

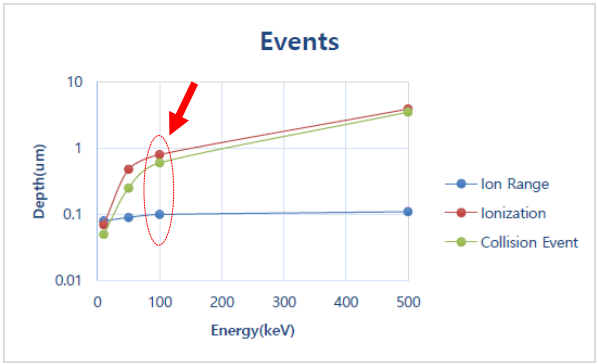

Fig. 4. The most probable point in related events.

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Fig. 5. The meaning of LENR

Table I: List of events.

Energy(keV)	Ion Range(um)	Ionization(um)	Collision Events(um)
10	0.08	0.07	0.05
50	0.09	0.48	0.25
100	0.1	0.8	0.6
500	0.11	3.9	3.5