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REACTIONS OF U^{238} WITH CYCLOTRON PRODUCED NITROGEN IONS

By

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The acceleration of N^{14} (+6) ions with the Berkeley Crocker Laboratory 60-inch cyclotron[1] has made it possible to study nuclear reactions of these ions with U^{238}.

The following transmutation products have been observed: $99^{247(?)}$, 99^{246}, Cf^{244}, Cf^{246}, $Cf^{247(?)}$, Cf^{248}, Bk^{243}, and other berkelium isotopes not yet identified. The identification of the elements was definitely established by their carrying on lanthanum fluoride precipitates and by their order of elution from a Dowex-50 ion exchange column.

The observed nuclear properties of these nuclides are summarized in Table I.

Table I

Nuclides Produced by U^{238} Plus N^{14} Ions

Nuclide	Half-life	Radiation	Alpha energy (Mev)	Remarks
$99^{247(?)}$	7.3 min	EC(?)α	7.35	
99^{246}	minutes	EC		Observed only through growth of its 1.5-day Cf^{246} daughter
Cf^{244}	45 min	α, EC(?)	7.15	
Cf^{246}	35.7 hr	α	6.75	
$Cf^{247(?)}$	~2.7 hr	EC		
Cf^{248}	225 day	α	6.26	
Bk^{243}	4.6 hr	EC, α	6.72 (30%) 6.55 (53%) 6.20 (17%)	
Bk	days	EC		Observed K x-rays; probably unresolved mixture of Bk^{245} and Bk^{246}

The nuclides Cf^{244}, Cf^{246}, Cf^{248}, Bk^{243}, and Bk^{245} have previously been observed in this laboratory.[2, 3]

The yields of the transcurium nuclides were low even though bombardment currents of 0.1 microampere of N^{14}(+6) ions of energy greater than 100 Mev were available. In three separate experiments a total of 40 alpha-emitting atoms of the 7.3-minute isotope of element 99 were observed to decay in the ion exchange column fraction immediately preceding californium, namely the eka-holmium position. Thus, the element identification is certain though the mass number can only be inferred on the basis of nuclear systematics. By observation of the

abundant fission product activity it was found that almost all of the nuclear reactions of nitrogen ions with U^{238} resulted in fission much as in the case of carbon ion bombardment of the same nucleus.

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[1] Rossi, Jones, Hollander, and Hamilton, Phys. Rev. (this issue).

[2] Hollander, Perlman, and Seaborg, Revs. Modern Phys. 25, 469 (1953).

[3] E. K. Hulet, Ph.D. Thesis, University of California Radiation Laboratory Unclassified Report UCRL-2283 (July 1953).