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Computer Program Calculates Gamma Ray Source Strengths of Materials Exposed to Neutron Fluxes

The problem:

Activation predictions are a significant part of radiation analysis. For example, activation of reactor components can determine their reuse in subsequent reactor tests. Also, activation of reactor test area and reactor components determines personnel access time at the reactor test sites after shutdown and removal of the reactor system. An activation analysis code is needed that includes a comprehensive element library not previously included in codes of this type.

The solution:

A computer program which contains an input library of nuclear data for 44 elements and their isotopes to determine the induced radioactivity for gamma emitters. Minimum input requires the irradiation history of the element, a four-energy-group neutron flux, specification of an alloy composition by elements, and appropriate selection of the output.

How it's done:

The activation code calculates gamma ray source strengths (in four energy groups) of materials exposed to neutron fluxes as a function of exposure and decay time. Options are provided in the code to calculate activity, including cyclic reactor operation of equal time duration and burnup of target material to account for flux depressions and resonance self-shielding. The program contains a library of nuclear properties (activation cross sections, isotopic fractions, decay constants, and gamma ray energy yields) for 44 elements, 200 isotopes, and 129 reactions, including radioactive captures and transmutations due to fast and thermal neutrons.

The input consists of control cards for calculation and print options, material composition, neutron flux, exposure time, and time at which the gamma activity is to be printed. The output may present activity by alloy, target element, or isotope for parent and daughter at each requested time. Running time is less than one minute for a typical alloy. The accuracy of the calculations is governed primarily by the accuracy of the material composition specification, and the neutron flux cross-section weighting.

Notes:

1. This program is written in modified Fortran II for use on the IBM 7090/94 computer.
2. Inquiries concerning this program may be made to:
   COSMIC
   Computer Center
   University of Georgia
   Athens, Georgia 30601
   Reference: B67-10665

Patent status:

No patent action is contemplated by AEC or NASA.

Source: L. O. Ricks and P. C. Heiser
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