

# Lawrence Berkeley National Laboratory

## Recent Work

### **Title**

Development of a database for prompt gamma-ray neutron activation analysis

### **Permalink**

<https://escholarship.org/uc/item/1kr0s748>

### **Authors**

Choi, H.D.

Firestone, R.B.

Lindstrom, R.M.

et al.

### **Publication Date**

2001

## Development of a Database for Prompt Gamma-ray Neutron Activation Analysis

H.D. Choi<sup>1</sup>, R. B. Firestone<sup>2</sup>, R. M. Lindstrom<sup>3</sup>, G. L. Molnár<sup>4</sup>,  
A.V.R. Reddy<sup>5</sup>, V. H. Tan<sup>6</sup>, C. M. Zhou<sup>7</sup>, R. Paviotti-Corcuera, A. Trkov

Nuclear Data Section-International Atomic Energy Agency, Vienna; <sup>1</sup>Seoul National University, Seoul, Korea; <sup>2</sup>Lawrence Berkeley National Laboratory, Berkeley, CA USA; <sup>3</sup>National Institute of Standards and Technology, Gaithersburg, Maryland, USA; <sup>4</sup>Institute of Isotope and Surface Chemistry, Chemical Research Centre, Budapest, Hungary; <sup>5</sup>Bhabha Atomic Research Centre, Trombay, Mumbai, India; <sup>6</sup>Vietnam Atomic Energy Commission Hanoi Vietnam; <sup>7</sup>China Institute of Atomic Energy, Beijing, People's Republic of China

Neutron-capture Prompt Gamma-ray Activation Analysis (PGAA) is a non-destructive radioanalytical method, capable of simultaneous multielement analysis. Inaccuracy and incompleteness of the available nuclear constants are significant handicaps in the application of this method. Following a recommendation by the International Nuclear Data Committee (INDC) the Nuclear Data Section (NDS) of the IAEA initiated a Co-ordinated Research Project (CRP) in 1999. The purpose of the CRP is to assemble a database of nuclear constants needed for the PGAA analysis in order to supplement the useful but older less complete data by A. Lone. Contributions from different laboratories around the world are listed below:

The **China** Institute of Atomic Energy released a new evaluation of energy levels and decay schemes properties of thermal-neutron capture for nuclides with mass number  $A=1-35$ .

In **Hungary**, the neutron capture gamma-ray spectra have been measured, at the Budapest PGAA facility, for 14 elements (Ca, Co, As, Mo, Ru, Sn, I, Ho, Tb, Lu, Hf, Ta, W, and Re) with the aim to complete the new, high-quality spectrum library for all naturally occurring elements, except the noble gases. Stoichiometric compounds were measured for 15 more elements (Ga, Ge, Se, Ru, Rh, In, Ce, Tb, Ho, Tm, Lu, Hf, Ta, Re, and Os). By comparing the new experimental data with ENSDF, a new catalogue of prompt gamma-ray data for PGAA is being created.

The Lawrence Berkeley National Laboratory (LBNL), **USA** is compiling capture gamma data, in collaboration with China, from the Evaluated Nuclear Structure Data File (ENSDF) updated to the current literature from Nuclear Science Reference (NSR) file, and recent measurements from the Budapest Reactor to develop a new database for PGAA. Dissemination software both for the Internet and standalone is being prepared in collaboration with Lund University (Sweden) and EVITech (Finland)

In **India** at the Bhabha Atomic Research Centre activities are centred on the experimental determination of PGAA nuclear constants for H, B, K, Co, Cu, Ca, Ti, Cr, Cd, Ba, Hg and Gd. Abundance of capture gamma-rays from <sup>60</sup>Co were also determined.

In **Korea** PGAA constants for light elements ( $A < 45$ ) are calculated using absolute gamma intensity data from the LBNL, Budapest facility and A. Lone data. Additional measurements at a new facility will be made early in 2001. Measurements will be used to verify PGAA constants for non- $1/v$  absorbers.

In **Vietnam** Atomic Energy Commission PGAA constants are measured for elements C, Na, K, Cr, Mn, Fe, Co, Ni, Cu, Cd, Ba, Ti, Sm, Gd, Hg, and Pb.

In the **USA** at NIST the intense thermal and cold neutron beams are used to measure PGAA constants for critical elements to cross check the results. Standard materials samples and blind samples of complex material are distributed to participants for data validation purposes.

The NDS of the IAEA expects to have a preliminary version of the database ready for free distribution to users in Member States early during 2002.