

# Sample Worth Measurement of Calcium Hydride

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**Abstract:** A small modular reactor (SMR) employing a solid moderator have attracted attention to the passive safety. A one of the solid moderator is calcium hydride (CaH<sub>2</sub>). Some integral experiments should be carried out to validate nuclear data of CaH<sub>2</sub>, however, no integral experiment by reactor for the validation have been reported. Therefore, reactivity worth measurements of CaH<sub>2</sub> samples as the integral experiments were conducted in a university training and research reactor (UTR-KINKI) of Kindai University.

The UTR-KINKI reactor is a light-water-moderated and graphite-reflected two-core (coupled-core) reactor. A graphite region between the two cores has been employed as a standard irradiation field which has a standard neutron spectrum consisting of 1/v and Maxwell distributions. The CaH<sub>2</sub> sample was placed in a cavity located at the center of the irradiation field.

The sample reactivity worth was determined from a difference between two excess reactivities of the respective reactors with and without the sample. The respective excess reactivities were measured using positive period method. The reactivity worth measurements were repeated for 21.20 g, 41.00 g, 72.78 g and 164.4 g of CaH<sub>2</sub> sample. From the present experiment, the following reactivity worth could be determined.

- 1) 21.29 g of CaH<sub>2</sub>,  $-0.0042 \pm 0.0003$  [%Δkk]
- 2) 41.00 g of CaH<sub>2</sub>,  $-0.0086 \pm 0.0003$  [%Δkk]
- 3) 78.72 g of CaH<sub>2</sub>,  $-0.0159 \pm 0.0004$  [%Δkk].
- 4) 164.4 go of CaH<sub>2</sub>,  $-0.0322 \pm 0.0007$  [%Δkk].

Furthermore, the sample reactivity worth was calculated using the continuous energy Monte Carlo codes MVP3.0 with the nuclear library JEFF-3.1, where each cross section of H and Ca constituting a molecule of CaH<sub>2</sub> was taken into the thermal neutron scattering law ( $S(\alpha, \beta)$ ). The ratios of calculated to experimental values (C/E) were  $1.19 \pm 0.72$ ,  $0.806 \pm 0.347$ ,  $0.874 \pm 0.189$  and  $0.894 \pm 0.100$  for 21.29 g, 41.00 g, 78.72 g and 164.4 g of the samples, respectively.