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Surrogate reactions for nucleosynthesis: $^{102,104}Ru(\alpha,\alpha')$ as surrogate reactions for $^{101,103}Ru(n,\gamma)$ J.A. CHURCH, L.A. BERNSTEIN, J.T. BURKE, F. DIETRICH, J. ESCHER, C. FORSSEN, E. NORMAN, LLNL, J. AI, Yale, L.W. PHAIR, R. CLARK, P.A. FALLON, D. LEE, I.Y. LEE, A.O. MACHIAVELLI, P. MCMAHAN, S. SINHA, M. STEPHENS, E. R.-VIEITEZ, M. WIEDEKING, LBNL — For two-step, neutron-induced reactions proceeding through an equilibrated intermediate state, an alternate, "surrogate reaction" technique (Cramer and Britt) is applicable. Measured decay probabilities for the intermediate nucleus formed via a light-ion reaction are combined with optical-model calculations for the formation of the same intermediate nucleus via the n-induced reaction, and result in the overall (n, γ/n/2n) cross sections. For the first time, we have extended this method to (n,γ) reactions important in nucleosynthesis. $^{102,104}Ru(\alpha,\alpha')$ were studied separately as surrogate reactions for $^{101,103}Ru(n,\gamma)$. The test, $^{101}Ru(n,\gamma)$, has been previously measured directly (EXFOR). The unknown, $^{103}Ru(n,\gamma)$, is a branch in the s-process. Energies of scattered α particles were detected in double-sided silicon detectors (STARS) over scattering angles of 42-60 degrees. Ge clover detectors (LiBerACE) were used to count γ-rays in coincidence with α particles scattered at energies corresponding to 0-3 MeV equivalent neutron energy in the desired (n,γ) reaction. Work performed under the auspices of the U.S. DOE by the Univ. of CA, LLNL contract W-7405-Eng-4, DOE grants DE-FG02-91ER-40609, and DE-FG03-03NA00081, and LDRD-04-ERD-057.

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