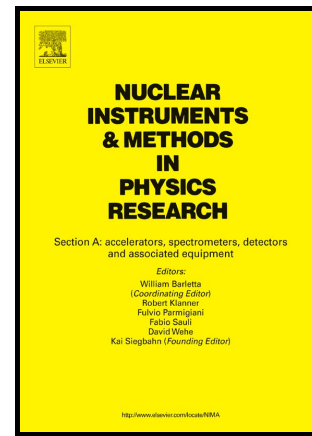


# Author's Accepted Manuscript

Diamond detectors for high-temperature transactinide chemistry experiments

Patrick Steinegger, Rugard Dressler, Robert Eichler, Dave Piguet, Silvan Streuli, Andreas Türlér



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1 Diamond detectors for high-temperature transactinide  
2 chemistry experiments

3 Patrick Steinegger<sup>a,b,\*</sup>, Rugard Dressler<sup>b</sup>, Robert Eichler<sup>a,b</sup>, Dave Piguet<sup>b</sup>,  
4 Silvan Streuli<sup>b</sup>, Andreas Türlér<sup>a,b</sup>

5 <sup>a</sup>*Departement für Chemie und Biochemie, Universität Bern, Freiestrasse 13, CH-3012*  
6 *Bern, Switzerland*

7 <sup>b</sup>*Labor für Radio- und Umweltchemie, Paul Scherrer Institut, CH-5232 Villigen PSI,*  
8 *Switzerland*

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9 **Abstract**

10 Here, we present the fabrication details and functional tests of diamond-  
11 based  $\alpha$ -spectroscopic sensors, dedicated for high-temperature experiments,  
12 targeting the chemistry of transactinide elements. Direct heating studies  
13 with this sensor material, revealed a current upper temperature threshold  
14 for a safe  $\alpha$ -spectroscopic operation of  $T_{det} = 453$  K. Up to this tempera-  
15 ture, the diamond sensor could be operated in a stable manner over long  
16 time periods of the order of days. A satisfying resolution of  $\approx 50$  keV  
17 FWHM was maintained throughout all conducted measurements. However,  
18 exceeding the mentioned temperature limit led to a pronounced spectroscopic  
19 degradation in the range of 453 – 473 K, thereby preventing any further  $\alpha$ -  
20 spectroscopic application. These findings are in full agreement with available  
21 literature data. The presented detector development generally enables the  
22 chemical investigation of more short-lived and less volatile transactinide el-  
23 ements and their compounds, yet unreachable with the currently employed  
24 silicon-based solid state sensors. In a second part, the design, construction,  
25 and  $\alpha$ -spectroscopic performance of a 4-segmented diamond detector, dedi-  
26 cated and used for transactinide element research, is given as an application  
27 example.

28 *Keywords:* Diamond, detector, alpha-spectroscopy, high-temperature,  
29 transactinides, vacuum chromatography

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\*Current affiliation: Joint Institute for Nuclear Research, Flerov Laboratory of Nuclear Reactions, Dubna, Russia

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