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# Two-stage polonium evaporation from liquid lead-bismuth at low temperature

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Understanding polonium evaporation from liquid lead-bismuth eutectic (LBE) is crucial for the safe design of innovative spallation targets and accelerator driven systems in which LBE is used as target material and coolant. Po evaporation from LBE has been investigated by several research groups in the last decade [1-5]. However, these evaporation experiments were carried out at higher temperatures than the operation temperatures of LBE-based nuclear installations. Very recent data at operation temperatures suggested much larger Po vapor pressures than expected from extrapolations of high-temperature data [5]. This increased volatility of course could have significant impact on the safety approach for LBE-based installations. In the present work, we have investigated this peculiar low-temperature polonium evaporation behavior in detail.

We carried out a series of time-dependent evaporation experiments below 500 ℃ using LBE doped with Po by neutron irradiation. The results revealed that the release of Po from LBE occurred in two stages. A first Po fraction already evaporated after short evaporation times. This fraction of Po was highly volatile, but was also depleted quickly during the first hours of the experiment. A second fraction of polonium dominated evaporation at longer times. The evaporation of this fraction was much more temperature-dependent. We also found that the short-time, highly volatile polonium was located at the sample surface, probably associated with a (Pb,Bi) oxide layer on top of the LBE sample. The bulk of the LBE did not show this volatile Po. Mathematical analysis of the data advanced two important conclusions: (i) the volatile surface polonium represented only a small fraction (10-4) of the total Po in the LBE sample and (ii) the bulk polonium evaporated according to the established high-temperature trend. These results showed that the apparently high Po vapor pressures observed in previous work [5] are caused by a small fraction of polonium in the sample and are a transient phenomenon.

References

[1] B. Gonzalez Prieto et al., J. Nucl. Mater. (2013), http://dx.doi.org/10.1016/j.jnucmat.2013.06.037.

[2] J. Neuhausen, U. Köster, B. Eichler, Radiochim. Acta 92 (2004) 917–923.

[3] S. Ohno, Y. Kurata, S. Miyahara, R. Katsura, S. Yoshida, J. Nucl. Sci. Technol. 43 (2006) 1359–1369.

[4] J. Buongiorno, C. Larson, K.R. Czerwinski, Radiochim. Acta 91 (2003) 153–158.

[5] M. Rizzi et al., Submitted to J. Nucl. Mater. (2013).

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