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An inexpensive and effective high-temperature oven for VENUS

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An important feature of ECR ion sources is their ability to form ion beams from any substance that can be introduced to the plasma in the gaseous state. For refractory substances that evaporate or sublimate at high temperatures, resistive heating is routinely employed to reach the required temperatures. Heating via these methods can necessitate the use of relatively high currents (100s of amps), which in superconducting ECR ion sources such as VENUS can lead to strong Lorentz forces that could easily destroy current-carrying components at elevated temperatures. At LBNL, we have had success in producing beams requiring temperatures up to 2000ºC, such as uranium[1], using a high-temperature oven designed at the lab[2]. However, for operating temperatures exceeding 1800 ºC, the lifetime of the oven is typically less than 1 week due to the strong Lorentz forces; unsatisfactorily short for desired long-term operations. Additionally, the fabrication of these ovens is both difficult and expensive. To alleviate this, a new lower-cost high-temperature oven requiring substantially lower heating currents is under development. The design features of this oven will be presented along with stress analysis for its use in high magnetic fields and the results of initial offline tests.

References

1. J. Benitez, *et al.*, Proceedings of ECRIS 2012, Sydney, Australia (2012).
2. T. Loew, *et al.,* Proceedings of PAC07, Albuquerque, NM (2007).