Isotopically Pure $^{24}\text{Mg}$ Is Prepared From $^{24}\text{MgO}$

The problem:
To prepare isotopically pure $^{24}\text{Mg}$, suitable for use in neutron scattering and polarization experiments. Because of the value of the pure $^{24}\text{MgO}$ starting material, the method used must assure a high product yield.

The solution:
An apparatus (see diagram) which permits thermal reduction of $^{24}\text{MgO}$ with aluminum and CaO, and subsequent vaporization of the product metal in vacuum according to the equation:

\[ 3\text{MgO} + \text{CaO} + 2\text{Al} \rightarrow 3\text{Mg} + \text{CaO}\cdot\text{Al}_2\text{O}_3 \]

How it's done:
The apparatus used for the $^{24}\text{MgO}$ reduction consists of a resistance-heated furnace tube and cap assembly. The tube contains an aluminum oxide crucible for holding the feed charges, tantalum radiation...
shields, a tantalum liner with a vapor guide, and a water-cooled cold finger for collection of the vaporized magnesium.

The charges to the reduction furnace are in the form of pellets prepared from a stoichiometric mixture of $^{24}$MgO and CaO together with aluminum in excess of the amount necessary. The pellets are outgassed at $5 \times 10^{-4}$ torr at a temperature between 600° and 700°C, then heated to 1150°C and held at this temperature for 2 hours to effect $^{24}$MgO reduction and product distillation.

Notes:
1. Product yields of $^{24}$Mg are reported for 7 runs to be 98.3% (std. dev. ±1.2%). Mass spectrometric analyses of product samples showed that the at% of magnesium isotopes to be: $^{24}$Mg, 99.91±0.01; $^{25}$Mg, 0.06±0.01; $^{26}$Mg, 0.03±0.01.
2. Additional details are contained in “Preparation of $^{24}$Mg from $^{24}$MgO,” by N. R. Chellew, R. K. Steunenberg, and J. D. Schilb, Argonne National Laboratory, which was published in *Nuclear Instruments and Methods*, 44 (1966), p. 149–150.

3. Inquiries concerning this innovation may be directed to:
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Patent status:
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