



The High-Temperature Couple made of $La_{3-x}Te_4$ and $Yb_{14}MnSb_{11}$.

that is thick enough to carry the requisite electrical current was overcome. A critical advantage over prior art is that this device was constructed using all diffusion bonds and a minimum number of assembly steps.

The fabrication process and the materials used are described in the following steps:

- (1) Applying a thin refractory metal foil to both sides of lanthanum tel-

luride. To fabricate the n-type leg of the advanced thermoelectric couple, the pre-synthesized lanthanum telluride coupon was diffusion bonded to the metal foil using a thin adhesion layer.

- (2) Repeating a similar process for the 14-1-11 Zintl p-type leg of the advanced thermoelectric couple.
- (3) Bonding thick CTE-matched metal plates on the metallized lanthanum

telluride and $Yb_{14}MnSb_{11}$ to form the hot and cold sides of the thermoelectric couple.

The calculated conversion efficiency of such an advanced couple would be about 10.5 percent, about 35 percent better than heritage radioisotope thermoelectric technology that relies on Si-Ge alloys. In addition, unlike Si-Ge alloys, these materials can be combined with many other thermoelectric materials optimized for operation at lower temperatures to achieve conversion efficiency in excess of 15 percent (a factor of 2 increase over heritage technology).

This work was done by Vilupanur A. Ravi, Billy Chun-Yip Li, and Jean-Pierre Fleurial of Caltech and Kurt Star of UCLA for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

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A Computer Model for Analyzing Volatile Removal Assembly

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A computer model simulates reactional gas/liquid two-phase flow processes in porous media. A typical process is the oxygen/wastewater flow in the Volatile Removal Assembly (VRA) in the Closed Environment Life Support System (CELSS) installed in the International Space Station (ISS). The volatile organics in the wastewater are combusted by oxygen gas to form clean water and carbon dioxide, which is solved in the water phase. The model

predicts the oxygen gas concentration profile in the reactor, which is an indicator of reactor performance.

In this innovation, a mathematical model is included in the computer model for calculating the mass transfer from the gas phase to the liquid phase. The amount of mass transfer depends on several factors, including gas-phase concentration, distribution, and reaction rate. For a given reactor dimension, these factors depend on pressure and

temperature in the reactor and composition and flow rate of the influent.

This work was done by Boyun Guo of the University of Louisiana at Lafayette for Glenn Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18369-1.