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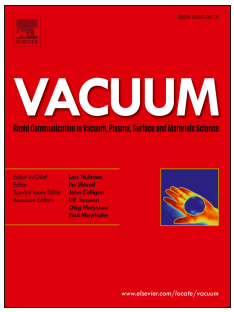

Miniature vacuum leak element made with porous nickel sheet

Chengxiang Wang, Yanwu Li, Detian Li, Yongjun Wang, Yongjun Cheng

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Miniature vacuum leak element made with porous nickel sheet

Chengxiang Wang, Yanwu Li*, Detian Li**, Yongjun Wang, Yongjun Cheng

Science and Technology on Vacuum Technology and Physics Laboratory, Lanzhou Institute of Physics, Lanzhou 730000, PR China

* Corresponding author.
**Corresponding author.
E-mail addresses: andersonliyanwu@sina.com (Y. Li), lidetian@hotmail.com (D. Li).

Abstract: Small characteristic sizes (< 1 μm) for vacuum leak elements are essential to achieve low conductances and high operating pressures in the free molecular flow regime. In this study, a miniature vacuum leak element is fabricated using a porous nickel sheet with pore size of less than 1 μm and a vacuum coupling radius seal (VCR) type gasket. One side of the porous nickel sheet is well sealed for restricting conductance by the simple polishing and sintering method, and a hole with diameter of about 100 μm is drilled with a laser in the sealing film for conducting gas. In the molecular flow regime, the typical conductance of the leak element is ~10^{-9} m^3/s, and the operation pressure can be up to about 5.0×10^4 Pa for Ar, and 1.0×10^5 Pa for He. Other advantages are: (1) the 4-VCR type leak element is very small, and can be easily fabricated; (2) the proper sintering process significantly improve the strength of porous material, and the presented leak is very robust; (3) the sheet shape for porous nickel is conducive to releasing the adsorbed gas; (4) technically, the porous nickel and the VCR nickel gasket can be welded together. Thus, the all-metal type leak is feasible.

Keywords: Miniature; Vacuum leak; Porous nickel; All-metal

1. Introduction

The use of vacuum leak elements is to limit gas flows or provide accurate flow rates, and are widely applied in vacuum metrology [1,2], vacuum leak detection [3], and gas sampling and analysis [4,5]. Some vacuum leak elements are obtained by drilling a hole in 1 mm thick metal sheets (stainless steel, aluminum, copper) with lasers [6]. These bakeable leak elements are simple, robust, and quite applicable. However, it is very difficult to get a