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Novel Method for Gas Sampling Nanoliter MEMS Packages to Determine Hermeticity[1]

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Microelectromechanical systems (MEMS) are attractive for applications requiring complicated, small electrically operated "machines." These complicated devices typically contain many moving parts and very large voltage gradients can exist across material interfaces. Thus, proper control of the internal atmosphere is a crucial requirement. The most definitive way to assess the hermeticity of the package is to sample and analyze the gas. MEMS packages are of various sizes and have internal volumes that range from about a milliliter down to tens of nanoliters. As the MEMS package size decreases, characterization of the internal atmosphere becomes increasingly difficult. Analysis of gases within milliliter-sized volumes is challenging enough with conventional technology; however, nanoliter-sized volumes are impossible. In this paper, we present a newly developed method for sampling a variety of MEMS packages, including those that have an internal volume of 30 nanoliters. The approach that was developed is radically different from standard techniques because of the custom hardware used and the pulsed method for gas introduction into the residual gas analyzer. This change enables not only the analysis of these small MEMS packages, but also a rapid way to analyze the gases repetitively in a statistically significant manner (e.g., gas from each package was analyzed *dozens of times during a 20 minute time period*). Challenges resulting from this paradigm shift include calibration, and sample and manifold preparation (will also be discussed).

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