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Commentary

Comments on "Ultra-low leak rate of hybrid compressive mica seals for solid oxide fuel cells"

Xiaohua Deng*

National Research Council Canada, ICPET, 1200 Montreal Rd, M-12, Ottawa, ON, Canada K1A 0R6

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Dr. Chou et al.[1] calculated "the leak rate L in standard cubic centimeters per minute at STP (sccm):

$$L=\frac{\Delta n}{\Delta t}=\frac{n_f-n_i}{t_f-t_i}=\frac{(P_f-P_i)V}{RT(t_f-t_i)}$$

where n is the moles of the gas, T the temperature, V the reservoir volume, R the gas constant, t the time, and P the pressure.

The L above is only a leak rate in moles per minute at non Standard conditions for Temperature and Pressure rather than in standard cubic centimeters per minute.

The proper expression for the leak rate in standard cubic centimeter per minute is shown below. The moles of the leaked gas Δn could be calculated based on the ideal gas law,

$$\Delta n=\frac{\Delta PV}{RT}$$

and volume ΔV of the leaked gas could be obtained from Δn and normalized into the standard condition:

$$\Delta V=\Delta n\frac{RT^{\circ}}{P^{\circ}}=\frac{\Delta PV}{RT}\frac{RT^{\circ}}{P^{\circ}}=\frac{\Delta PVT^{\circ}}{P^{\circ}T}$$

Then the leaking rate could be calculated from below equation:

$$L=\frac{\Delta V}{\Delta r}=\frac{\Delta PVT^{\circ}}{\Delta tP^{\circ}T}$$

where T° and P° are the temperature in K and pressure at the standard condition.

* Tel.: +1 613 990 0991; fax: +1 613 991 2384.
E-mail address: joshuadeng@yahoo.ca.

[1] Y.-S. Chou, J.W. Stevenson, L.A. Chick, Journal of the Power Sources 112 (1) (2002) 130–136.

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