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John T. Park
Missouri University of Science and Technology

E. Redd

T. J. Kvale

E. Rille

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NOTES

BRIEF contributions in any field of instrumentation or technique within the scope of the journal should be submitted for this section. Contributions should in general not exceed 500 words.

Reactive scattering cell for atomic hydrogen and deuterium

J. T. Park, E. Redd, T. J. Kvale, and E. Rille

Physics Department, University of Missouri-Rolla, Rolla, Missouri 65401

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A design for a high-temperature reactive scattering cell for atomic hydrogen and atomic deuterium is described. At approximately 2700 K a dissociation of the molecular target species of over 95% has been obtained. The lifetime of 340 h of operation is sufficient for precision, long-time, differential cross-section measurements.

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The furnace target technique, described in the literature,[1-3] gave the principal basis for our design of a high-temperature reaction scattering cell. Differential cross-section measurements of ion scattering by atomic hydrogen produced in a high-temperature scattering cell have been reported.[4] This scattering cell[5] has been improved in operation (see Table I) so that precision measurements of angular differential cross sections could be obtained. These recent measurements of differential cross sections included both atomic hydrogen and atomic deuterium as the target species.[6,7]

Figure 1 shows a schematic drawing of the improved version of the high-temperature scattering cell. The central part of the scattering cell is the high-temperature furnace, which consists of two tungsten tubes. These coaxial tungsten tubes are connected at one end by a tungsten ring. The other ends of the tungsten tubes are swaged between copper plates which provide the electrical connections. The dc current flow, for joule heating, is radial in both the connecting copper plates and the tungsten ring and is coaxial in the tungsten furnace walls. This arrangement of the dc current flow through the tungsten tubes assures that no component of magnetic field exists along the furnace axis.

The tungsten furnace is constructed of tungsten tubes which are rolled from a 0.025-mm tungsten sheet. The edges are welded together by inserting 0.012-mm tantalum strips between the edges of the tungsten sheets. The resulting "sandwich" is spotwelded together. A similar technique is used to connect the tungsten tubes to the tungsten rings.

Molecular target gas entering the region between the hot tungsten tubes is dissociated by a catalytic reaction on the hot tungsten surfaces. From there target-gas particles can diffuse through small holes (~ 0.3 mm) in the inner tungsten tube into the center of the high-temperature furnace region. There the scattering processes occur between the incident projectile beam, directed along the furnace axis, and the target-gas species. The pressure in the scattering region is determined by a MKS Baratron Model 170 pressure meter.

The differential pumping of the cylindrical inner volume is provided by tungsten cones at each end of the furnace. The tips of these cones are equidistant from the accelerator pivot point and define the projectile–target interaction length. The exit cone assembly, consisting of the tungsten exit cone and its molybdenum holder, is solidly mounted through insulating supports to the stationary magnet-decelerator part of the apparatus. A stainless-steel welded bellows provides the flexible connection between the exit cone assembly and the scattering cell. This allows both precise pivoting of the projectile beam axis about the scattering center and gas containment for differential pumping.

Heat shields consisting of cylindrical tungsten tubes are mounted coaxially around the furnace to reduce the heat loss through radiation.

The water-cooled copper supports, with the installed tungsten furnace, are mounted by means of an insulator to the floor of the scattering cell housing. A 6-in. oil diffusion pump evacuates the high-temperature cell and the housing

TABLE I. Operation parameters of the old and new high-temperature reactive scattering cell.

Operation parameter	Old cell[a]	New cell
Voltage (V)	3.05	4.74
Current (A)	92	68
Power (W)	281	322
Temperature (K)	~ 2500	~ 2700
Dissociation fraction (%)	> 95	> 95
Lifetime (h)	120	340
Background pressure (Torr)	5×10^{-7}	1×10^{-7}
Water (30 °C) cooling (l/min)	3–5	3–5

[a] Reference 4.

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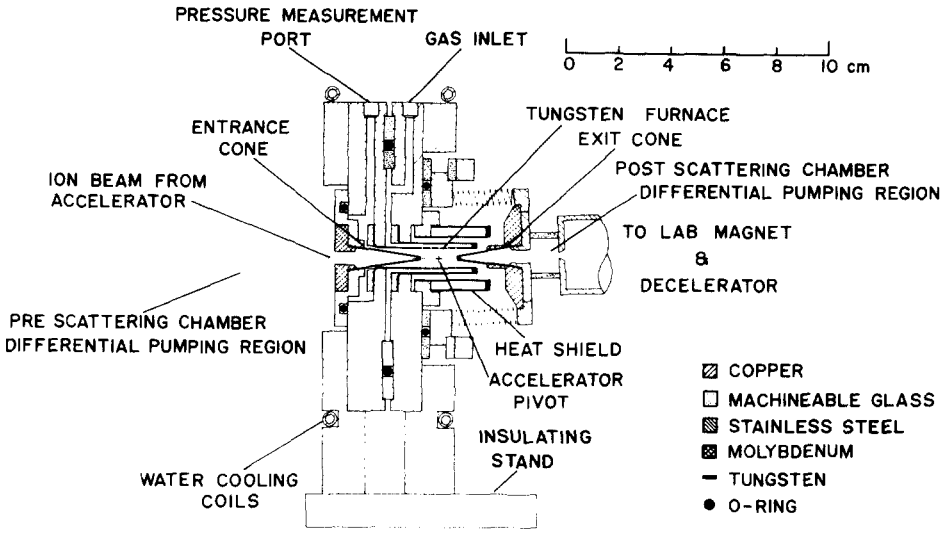

FIG. 1. Schematic drawing of the high-temperature reactive scattering cell.

to $\sim 10^{-7}$ Torr with no gas load and to $\sim 10^{-6}$ Torr with 10-μ target-gas load in the high-temperature cell.

The current version of the scattering cell has an average lifetime of approximately 340 h when operated at an estimated temperature of 2700 K. This temperature is adequate to assure over 95% dissociation of the molecular target gas in the furnace. The lifetimes of the furnaces depend on both the operation parameters and on the construction of each individual furnace. By accepting a slightly lower dissociation fraction of the molecular target species, which means operating the furnaces at lower temperatures, considerably longer lifetimes of the furnaces could be achieved.

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Simple synchronous video image combiner

A. L. V. S. Lage, A. O. S. Gomes, and O. D. D. Soares

Centro de Física da Universidade do Porto, 4000 Porto, Portugal

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A simple and inexpensive TV camera image combiner for several purposes in current video dual image acquisition is described.

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TV camera systems are currently being used in a large spectrum of scientific applications.

Combining two independent TV camera images into a single image on a display monitor was found to be advantageous in some situations. A simple circuit was conceived to allow a synchronous two video images combiner (Fig. 1). It is essential to observe that the images combiner uses a unique master synchronization signal of a TV system which must serve both of the TV cameras. The circuit consists of a timer triggered by the unique synchronization signal which controls a switch composed of T_1, T_2, and T_3 (Fig. 1), functioning as a selective gate for the video signal. A video amplifier

