THE UNIVERSITY OF WISCONSIN

MADISON 6

DEPARTMENT OF PHYSICS
STERLING HALL

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Professor Joshua Lederberg
Department of Genetics
Stanford University School of Medicine
300 Pasteur Drive
Palo Alto, California

Dear Joshua:

I have talked with a few of our people here in regard to the problems you bring up and have no clear answers. We have studied high energy (1 MeV) molecular ions as they move through a metal target. In this case the electron appears to be lost very close to the surface, probably in the first few atomic layers and the two protons then move apart. I should expect this behavior for 10 keV molecular ions but at this energy more would be back scattered. I should expect practically all back scattered particles to be atomic and you would have a mixture of H_1^+, H_1^o, and H_1^-. A number of people working with Jim Tuck at Los Alamos investigated charge states of protons that traveled through thin foils and emerged at low energy. I believe I heard J.A. Phillips of Los Alamos give a talk on this subject. I haven't found a reference for this work but believe it was in about 1955.

Even at energies of 100 eV I would expect back scattered particles to be atomic and to be a mixture of H_1^+, H_1^o, and H_1^-.

Particles that pass into the metal are expected to be fairly mobile in many metals and to exist as separate protons.

If the ions have energies of only a few electron volts the situation may be much different. Atomic hydrogen impinging on a cold metal re-emerges as molecular hydrogen. I should expect low energy (say 10 eV or less) molecular ions to behave

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similarly. However there might be interchange so that the pair of protons coming off might not be the pair that hit. If the metal is hot (say 2000° C) 10 eV molecules or H_2^+ hitting will be dissociated and will come off as neutral atoms.

We have been looking at chemical reactions involving hydrogen on metal surfaces. These may be important if the ions have very low energies.

Sincerely,

R. G. Herb
Professor of Physics

RGH:jp