INELASTIC SCATTERING OF RADICALS FROM A LIQUID SURFACE

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Highly cooled NO molecules are scattered from a liquid gallium surface to probe rotationally and electronically inelastic scattering from a molten metal. After collisions at 45 degrees with respect to the surface normal, specularly scattered populations are detected by confocal laser induced fluorescence (LIF), yielding rotational, spin-orbit, and lambda-doublet population distributions. Reverse seeding is employed to vary incident collision energy from 1.0(3) to 20(6) kcal/mol. The lowest collision energies result in single-temperature distributions for scattered NO molecules.

Interestingly, the resulting temperature is considerably lower than that of the surface, a likely manifestation of rotational cooling on desorption from an energetic well binding the molecule to the liquid metal. Increasing collision energy results in a strong effect on scattered NO rotational energy but a weak effect on spin-orbit branching. The opposite trend is seen for changes in surface temperature, namely strong dependence for electronic excitation but weak dependence for rotationally inelastic scattering. This clear difference between electronic and rotational dynamics is discussed in terms of the possible influence of electron hole pair excitations in the conducting metal.