APPLICATION OF SPUTTERING METHOD TO THE OBSERVATION OF ROTATIONAL SPECTRA OF METAL-CONTAINING MOLECULES

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It is hard to produce sufficient number of metal-containing molecules in the gas phase. We have recently found that sputteirng in discharge works as a good source of metal atoms for rotational spectroscopy. A thin sheet of metal is laid on a cylindrical electrode in a free space cell. Metal atoms sputtered from the metal sheet can react with precursor molecules under glow discharge at low temperature. By choosing a metal and precursors appropriately, we can produce wide varieties of compounds composed of a metal and other nonmetallic atoms.

In this contribution, observation of rotational spectra of nickel or gold-bearing transient species formed via sputtering reactions is described. The rotational spectra of a series of molecules MX, where M is gold or nickel and X represents halogens, are observed in the millimeter- and submillimeter-wave regions. Change in the electronic ground states of NiX (X=F, Cl, Br, and I) and the interaction between electronic excited states and the ground state are clearly evidenced in the rotational spectrum. In addition, triatomic species NiCO is detected. Data from isotopic species are used to derive the molecular structure. Works on gold-bearing compounds will also be presented.