BEYOND IRC+10216: NEW TRENDS IN THE DETECTION OF METAL MOLECULES TOWARDS CIRCUMSTELLAR ENVELOPES

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New millimeter-wave observations towards the circumstellar envelopes of several late-type carbon stars have resulted in the detection of various metal-bearing species which, until now, have only been seen in IRC +10216. Measurements at 1, 2, and 3 mm with the ARO Kitt Peak 12 m telescope and the IRAM 30 m towards CRL 2688 have resulted in the identification of MgNC, NaCN, NaCl, and AlF in this source. In addition, MgNC has been detected in the circumstellar shell of CRL 618. These data indicate that metal-containing molecules are common constituents of circumstellar envelopes and may survive into the planetary nebula stage. The chemical formation processes of these molecules are quite uncertain, however. Although standard thermodynamic equilibrium chemistry has been thought to produce metal halides, for example, these new observations indicate that shock waves may be responsible for creating NaCl and NaCN in CRL 2688. "Shock chemistry" could be creating metal cyanides in IRC+10216 as well, although radiative association reactions may also play a role. Current theories of circumstellar metal molecule formation as well as future observational and spectroscopic challenges will be discussed.