EXOTIC METAL MOLECULES IN OXYGEN-RICH ENVELOPES: DETECTION OF AlOH ($X^1\Sigma^+$) IN VY CANIS MAJORIS

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A new interstellar molecule, AlOH, has been detected toward the envelope of VY Canis Majoris, an oxygen-rich red supergiant. Three rotational transitions of AlOH were observed using the facilities of the Arizona Radio Observatory (ARO). The J = 9 $\rightarrow$ 8 and J = 7 $\rightarrow$ 6 lines at 1 mm were measured with the ARO Submillimeter Telescope (SMT), while the J = 5 $\rightarrow$ 4 transition at 2 mm was observed with the ARO 12 m antenna on Kitt Peak. The AlOH spectra exhibit quite narrow line widths, indicating that the emission arises from within the dust acceleration zone of the central circumstellar outflow. From a radiative transfer analysis, the abundance of AlOH relative to H_2 was found to be $1x10^{-7}$ for a source size of $0.26''$ or 22 R_*. AlOH is likely formed just beyond the photosphere via thermodynamic equilibrium chemistry, and then disappears due to dust condensation. The AlOH/AlO abundance ratio found in VY CMa is $\sim$17. LTE calculations predict the monohydroxides should be the major carriers of Al, Ca, and Mg in O-rich envelopes, as opposed to the oxides or halides.