INFRARED EMISSION SPECTROSCOPY OF THE $A\ ^4\Phi_i - X\ ^4\Delta_i$ AND $B\ ^4\Pi_i - X\ ^4\Delta_i$ TRANSITIONS OF CoS

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The near-infrared emission spectrum of CoS has been recorded at a resolution of 0.04 cm^{-1} using a Fourier transform spectrometer. Gas-phase CoS was produced by the reaction of cobalt vapor and CS_2 vapor at about 3000 K in a carbon tube furnace. Two electronic transitions were observed for the first time in the 3200-6000 cm^{-1} region and have been assigned to the $A\ ^4\Phi_i - X\ ^4\Delta_i$ and $B\ ^4\Pi_i - X\ ^4\Delta_i$ transitions. The 0–0 bands for all four sub-bands of the $A\ ^4\Phi_i - X^4\Delta_i$ transition, and the 0–0, 0–1, 1–0 and 1–1 bands for the 5/2–7/2 sub-band of the $B\ ^4\Pi_i - X\ ^4\Delta_i$ transition were rotationally analyzed. Combined with the previous microwave data from the literature, the present data were fitted using the usual Hund's case (c) energy level expressions, and spectroscopic constants were obtained for the $X\ ^4\Delta_i$, $A\ ^4\Phi_i$ and $B\ ^4\Pi_i$ states of CoS. A Hund's case (a) fit was also carried out for the $A^4\Phi_i - X\ ^4\Delta_i$ transition. The presence of a low-lying $^4\Phi_i$ state for both CoO and CoS was not anticipated based on the previous experimental and theoretical work. The near-infrared emission spectrum of NiS has also been recorded under similar experimental conditions as for CoS, and the analysis is pending due to its congested nature. Microwave spectra of NiS are desirable to assist in the analysis of this spectrum.