100° over a period of 2-3 hours and quenched. Although no attempts were made to determine the exact dependence of x on T and P, high pressure was necessary to obtain $Cr_xCo_{1-x}S_2$ solid solutions. For example, at a reaction pressure of 3 kbars, a maximum value of $x \simeq 0.01$ was achieved. When the pressure was raised to 30 kbars, this increased to $x \simeq 0.1$ and at 65 kbars to $x \simeq 0.4$.

Pyrite-type phases usually formed at the ends of the reaction pellets as black, rod-like crystals that could be manually separated from other phases, principally Cr_2S_3. In those reactions for which the initial Cr content was $x \lesssim 0.15$, single-phase products were indicated by Debye-Scherrer x-ray patterns. Amounts of Cr_2S_3 below the level of detection by the x-ray technique may, however, still have been present in these samples. Cell dimensions of these pyrites, for which composition could be reasonably assumed to be identical to that of the nominal reaction stoichiometry, and that of a sample from one experiment in which a sufficient number of crystals could be isolated for chemical analysis provided a means of estimating the compositional dependence of the cubic cell edge, $\underline{a}$. These cell constants, as well as those for all other pyrites discussed in this paper, were refined from Debye-Scherrer data, using a computerized least-squares procedure in which the Nelson-Reilly function is one parameter. Values of $\underline{a}$ for x = 0.05, 0.10, and 0.15 (assumed from nominal stoichiometry of single-phase products) and for x = 0.00 and x = 0.164 (confirmed by chemical analyses) are given in Table I. These values, when plotted $\underline{vs.}$ x, fall within 0.001Å of a linear, Vegard-like function given in angstroms by $\underline{a}(x) = 5.5345 + 0.06x$. Compositions of products described in this paper other than those given in Table 1 were estimated from their lattice dimensions using this compositional dependence.

TABLE 1

Cell Dimensions of Defined Compositions in the System $Cr_xCo_{1-x}S_2$

Formula	a_o (Å)
$Cr_{0.164}Co_{0.836}S_{2.01}$ (a)	5.5450 ± (1)
$Cr_{0.15}Co_{0.85}S_2$ (b)	5.5422 ± (1)
$Cr_{0.10}Co_{0.90}S_2$ (b)	5.5400 ± (1)
$Cr_{0.05}Co_{0.95}S_2$ (b)	5.5380 ± (1)
CoS_2 (a)	5.5345 ± (1)

(a) Defined by chemical analysis.
(b) Defined by starting composition of single-phase product.

Magnetic properties were measured with a vibrating sample magnetometer. Saturation magnetizations were determined in fields up to 16 kOe. Curie temperatures were measured in fields of ~300 Oe by estimating the inflection points on graphs of σ vs. T. In many cases, the curves descended gradually to $\sigma = 0$ suggesting a possible range of composition in the sample. Curie temperatures obtained by extrapolation to $\sigma = 0$ are a few percent higher.

Electrical properties were measured on single crystals by a four-probe technique. Resistivities were nearly independent of both temperature and composition. One crystal of composition $Cr_{0.22}Co_{0.78}S_2$ showed $\rho_{4.2°K} = 4.0 \times 10^{-4}$ ohm-cm and $\rho_{612°K} = 5.0 \times 10^{-4}$ ohm-cm.

Results and Discussion

Magnetic measurements on a series of $Cr_xCo_{1-x}S_2$ compositions are listed in Table 2. Stoichiometries indicated for these compositions were derived from unit cell dimensions as described above. These derivations and the magnetic data associated with them are subject to several sources of possible error;