



Fig. 1—Alloys studied in Cu-Sn-Mn system.

Table I. Enthalpies of Formation as a Function of Composition in the Cu₂Sn-Mn System

Chemical Unit	Alloy	ΔH^f (cal/mole)
Cu _{2.445} Mn _{1.0} Sn _{0.215}	1	-3,400 ± 1,000
Cu _{1.783} MnSn _{0.313}	2	-3,100 ± 1,100
Cu _{1.828} MnSn _{0.510}	3	-3,900 ± 700
Cu _{2.020} MnSn _{1.012}	4	-2,200 ± 1,000
Cu _{2.323} MnSn _{1.805}	5	-1,600 ± 1,200

The Enthalpies of Formation of Ferromagnetic Cu-Mn-Sn Alloys

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THE enthalpies of formation at 298.16 K of five alloys closely approaching the composition Cu₂MnSn were determined by solution calorimetry with tin as a solvent. The alloys are in the ferromagnetic β phase range; their compositions, as well as the maximum range for the β phase are shown in Fig. 1. This phase is ordered and presents reasonably high magnetizations (up to 660 emu/cm³). The β phase decomposes upon cooling below 400°C. Alloys were prepared by arc melting. They were homogenized and quenched to retain the β phase at room temperature.

The liquid-metal solution calorimeter used in this investigation has been described elsewhere.¹ At the start of each series of measurements, the solvent bath consisted of about 0.4 g-atom of 99.9+ pct pure Sn. The heat capacity of the calorimeter was determined by two tin drops before each series of experiments. The only heat effect due to a tin drop is the sensible heat of the specimen. The heat content of tin is well established and is presented in the compilation of Hultgren *et al.*²

The calculation of the enthalpies of formation of the alloys was made on the basis of the enthalpies of solu-

tion of the alloy and of the constituent elements, as shown in the expression below:

$$\Delta H^f_{\text{Cu}_x\text{Mn}_y\text{Sn}_z} = x\Delta H_{\text{Cu}}^{\text{soln}} + y\Delta H_{\text{Mn}}^{\text{soln}} + z\Delta H_{\text{Sn}}^{\text{soln}} - \Delta H_{\text{Cu}_x\text{Mn}_y\text{Sn}_z}^{\text{soln}}$$

The results obtained are shown in Table I.

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1. M. J. Pool: *Trans. TMS-AIME*, 1965, vol. 233, pp. 1711-15.

2. R. Hultgren, R. L. Orr, P. D. Anderson, and K. K. Kelley: *Selected Values of Thermodynamic Properties of Metals and Alloys*, John Wiley and Sons, 1963.

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