TABLE I. Composition of alloys.

Alloy designation	Composition (wt% Mn)
Fe	0
Fe-0.4Mn	0.38
Fe-4Mn	4.10
Fe-7Mn	7.37
Fe-14Mn	13.62

purity. The alloys were arc melted in an argon atmosphere under conditions which insured good homogeneity. Hot-rolled samples having dimensions 20×6.0×1.3 mm were machined and annealed for 9 h at temperatures between 900–950 °C. Half of the specimens were quenched from the austenitic region and the rest were furnace cooled to room temperature in 72 h. Plane-wave shock-deformation tests were performed at peak pressures of 90, 150, 300, and 500 kbar. The basic method of plane-wave generation has been described previously.[7]

B. Experimental Methods

Magnetization curves for shock deformed and annealed specimens were determined by standard "ring techniques" described by Rose, Villere, and Berger.[8] All measurements were taken at room temperature. The maximum applied field was 1000 Oe.

Density was measured at the National Bureau of Standards and at the Naval Weapons Laboratory using a displacement technique. Density changes of ±0.0001 g/cm^3 were detectable. The liquid used in determining the density was Di(2-ethyl hexyl) azelate.

Crystal structures and microstructures were observed with x-rays, electron probe, light, and transmission electron microscopy.

The electron probe was used to study variations of manganese concentrations and to facilitate the interpretation of the optical micrographs. The Norelco instrument was operated at 30 kV with a specimen current between 0.035 and 0.05 μA. To determine the manganese content within the bcc and close-packed phases, a calibration curve of relative intensity $(I/I_0)_{Mn}$ vs manganese content was determined using four homogeneous Fe-Mn alloys (Fig. 3). It was of interest to show that the calibration curves agree with the calculated curves of Castaing[9] and Wittry[10] who made corrections for absorption and fluorescence.

Identification of the retained high-pressure was accomplished by x-ray diffraction of powdered Fe-Mn using Mo$K\alpha$ radiation. Thin foils, suitable for examination by electron transmission microscopy, were electropolished in a solution consisting of 430 ml of H_3PO_4, 50 g of CrO_3, and 7 ml of distilled water at 0 °C and a current density of 1.2 A cm^{-2}.

III. EXPERIMENTAL RESULTS

A. Density Experiments

Density measurements are shown in Table II. Density measurements of the quenched and shock-loaded

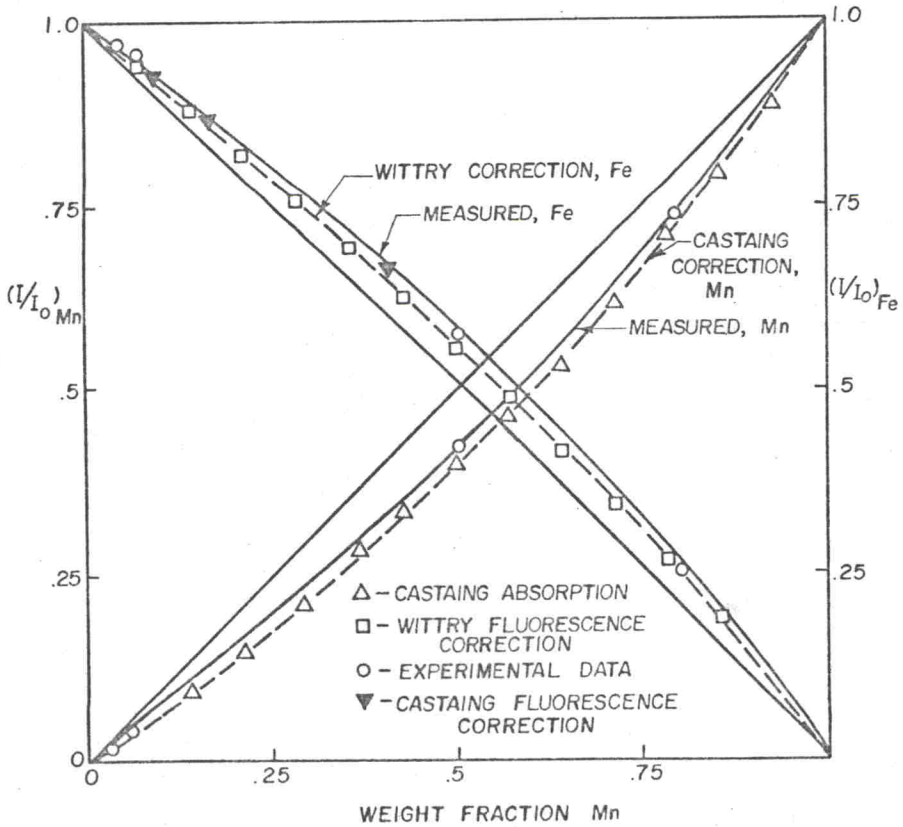

FIG. 3. Measured I/I_0 vs composition curves for the Fe-Mn system.