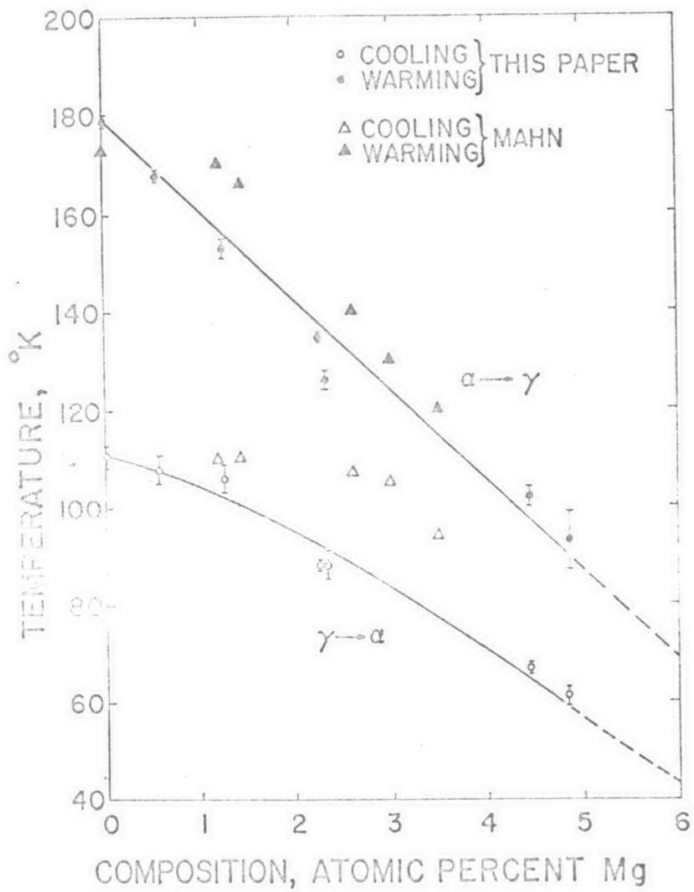

Fig. 4. The $\gamma \to \alpha$ and $\alpha \to \gamma$ transformation temperatures of some cerium-magnesium alloys as a function of composition.

*γ-α Transformation Temperatures.** The $\gamma \to \alpha$ and $\alpha \to \gamma$ transformation temperatures that were determined in the present investigation are shown in figure 4 along with Mahn's[7] transformation temperatures, which were determined from the reciprocal of the magnetic susceptibility-versus-temperature curves. The agreement between the two sets of data seems to be reasonable except

* The transformation temperatures are listed in Appendix II.

for the $\gamma \to \alpha$ transformation temperatures of the alloys containing more than 2 a/o magnesium. This discrepancy may be due in part to different kinds or amounts of impurities in the starting materials, and possibly to the difference between the experimental techniques used to measure the transition temperatures. The solid lines drawn in figure 4 are based on the data obtained in this investigation.

Existence of a Critical Point. Some evidence that suggests the existence of a critical point between 6 and 12 a/o magnesium was obtained. The average slopes of the transformation temperature-versus-composition curves, figure 4, from 0 to 5 a/o magnesium are $-10.9°$ and $-18.4°$K per 1 a/o for the $\gamma \to \alpha$ and $\alpha \to \gamma$ transformations, respectively. It should be noted that the $\gamma \to \alpha$ transformation temperature-versus-composition curve is not linear between 0 and 3 a/o magnesium, but that it appears to be linear at compositions greater than 3 a/o. The slope of the linear portion of this curve is $-13.3°$K per 1 a/o. The intersection of these two transformation temperature curves is calculated to be 11.0 a/o magnesium and 23°K(-296°C) if the slope of the linear portion of the $\gamma \to \alpha$ curve is used, or 9.1 a/o magnesium and 12°K (-261°C) if the average value of this slope is used.

The length change* for the $\gamma \to \alpha$ transformation (figure 5), as taken from the dilatometric curves, was found to increase with increasing magnesium content up to about 1.5 a/o. At higher magnesium contents this effect was reversed and the volume change was found to decrease with increasing magnesium content. Although these data are suggestive of a critical point between 6.1 (solid line) and 11.1 (dashed line) a/o magnesium, the solubility limit at 5.9 a/o prevents obtaining experimental confirmation of this interpretation of the data. The value of the length change of the 4.83 a/o magnesium alloy may be too low because the transformation may not have gone to completion at the lowest temperature attainable (48°–50°K) in this study. Thus, the dash line is probably a more accurate representation of the true behavior of these alloys than the solid line.

* These data are tabulated in Appendix II.