DISCUSSION

S. G. McDonald (general discussion)—Parallel sets of data at two test temperatures for the ion-induced swelling of Type 304 stainless steel, which were presented at this symposium, are compared in Figs. 9 and 10. The GE data (Rosolowski and Johnston, solid squares) were obtained for 5-MeV $^{58}Ni^+$ irradiations at temperatures of 550 and 625 C (1022 and 1157 F) at a calculated

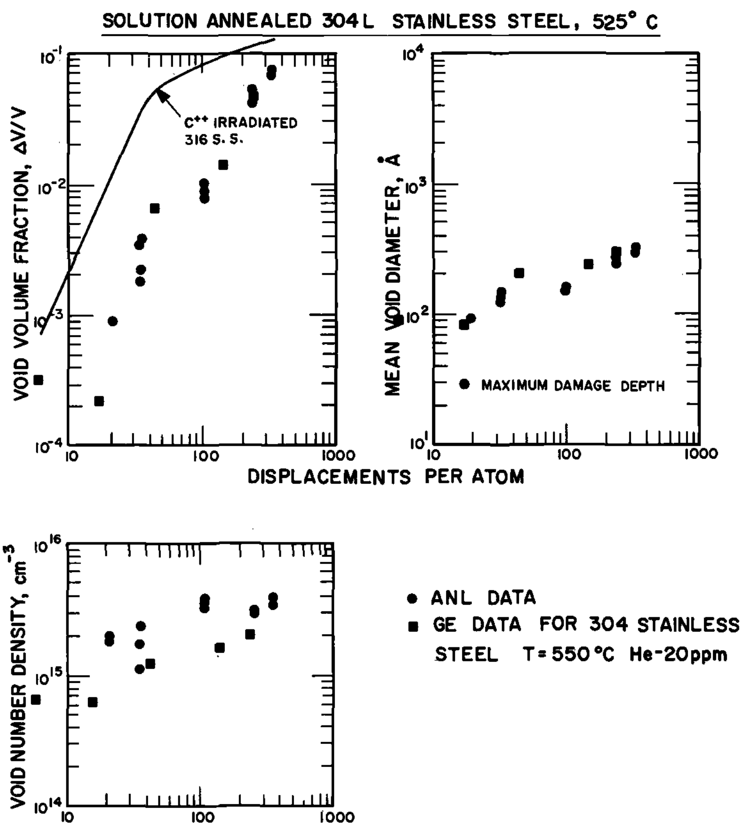

FIG. 9—*Superposition of swelling results for Type 304 stainless steel obtained at ANL for 525 C (977 F) irradiations ●, and at G.E. for 550 C (1022 F) irradiations ■.*

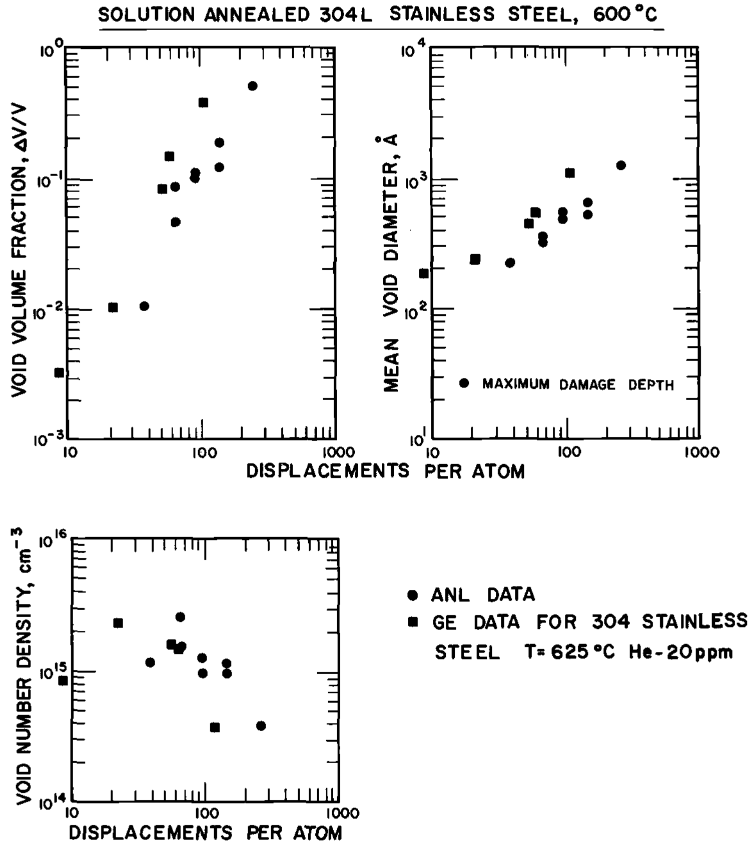

FIG. 10–*ANL swelling data for 600 C (1112 F)* ○, *and G. E. data at 625 C (1157 F)* ■.

displacement rate of ~2 x 10^{-2} dpa s^{-1}, whereas the ANL data were for 4-MeV irradiations at 525 and 600 C (997 and 1112 F) at a displacement rate of 5 x 10^{-3} dpa/s^{-1}. To a first approximation, the 25 C (45 F) temperature difference between the corresponding data is compensated by the flux difference, so we conclude that excellent agreement is obtained between the swelling data of these two studies. The results indicate that the ion-simulation techniques used were independent of the ion energy. In particular, neither set of data exhibited saturation effects such as those reported earlier by Hudson et al [*13*] for Type 316 stainless steel irradiated at 525 C (997 F) with 22-MeV C^{++} ions. Their data are shown by the solid line in Fig. 1. In the results at ~600 C (1112 F), the absolute magnitude of the swelling in the GE data is greater than in the ANL data, but the dosage dependence is similar. The apparent differences in swelling at high temperature originate from the ΔV correction to the foil volume, namely, = $\Delta V/(V-\Delta V)$, used in reporting the GE data only.

Although some systematic differences are apparent, the overall development of the microstructures was quite similar for both experimental conditions. Swelling was mainly due to the growth of voids nucleated below 20 dpa. The reduction in void number density and the corresponding increase in mean void diameter for the higher-temperature data are consistent with the general trend in void formation.

The effect of rastering the focussed beam was to promote void nucleation without the presence of helium atoms. The void growth appears to be characteristic of the time-averaged displacement rate, the total displacement dosage, and the temperature of the irradiation, and insensitive to fluctuations in the displacement rate ≈ 1 ms.