by diffusion short circuits in the iron matrix. Grain boundaries can act as short circuits for diffusion in precipitation,[10] but the large grain size in the present samples eliminates this possibility. Isolated dislocation lines may also provide routes for rapid diffusion,[11] thus giving a lower activation energy for long-range diffusion than for site exchange. To test this possibility two wires were strained after quenching, and then the activation energy for precipitation was determined in the same way as for the unstrained wires. As shown in Table 1 the activation energies for wires strained 1 per cent and 4 per cent were the same, within experimental error, as for the unstrained wires. Therefore a large change in the dislocation density does not appreciably affect the activation energy for diffusion in precipitation, and dislocation lines are probably not acting as diffusion short circuits. The strain field around a precipitate particle may enhance solute diffusion in its vicinity, but in this case one would expect that the activation energy would depend upon the particle size. As will be discussed in another report, the number density of carbide particles was much greater at lower aging temperatures for the same carbon concentration, so the particle size was smaller, particularly for sample number one. This sample gave the same activation energy as the others, however, so the diffusion was apparently not strongly affected by the size of the precipitate particles. Quenched-in defects might cause a lower activation energy for diffusion, but a wire that was air-quenched showed about the same rate of precipitation as the water-quenched wires, although some carbon precipitated at higher temperatures in the air-quench. Thus none of the more obvious possibilities for short circuiting diffusion seems to be operative here, although a more subtle mechanism may be responsible for the lower activation energy of precipitation.

One can estimate the pre-exponential factor appropriate to an activation energy of 17.1 kcal/mole for diffusion during precipitation if the carbide particle size is known. Coercive force measurements[12] indicate that the carbide particle diameter at aging temperatures from 200° to 250°C is in the range 500–1000 Å at about 95 per cent precipitation, although this estimate is rather uncertain. From an electron micrograph, Tsou *et al.*[13] concluded that the carbide particles in α-iron aged 1 hr at 100°C were about 300–500 Å in diameter. If a value of 400 Å is used with comparable data on precipitation, the carbon diffusion coefficient at 100°C can be estimated to be roughly 10^{-13} cm^2/sec. Then the diffusion coefficient of carbon during precipitation in α-iron is approximately

$$(10^{-3}) \exp(-17{,}100/RT).$$

The absolute values of number densities of carbide particles that have been calculated using equation (1) must be questioned as a result of this study. In particular the calculations of the author in two previous reports[2,4] should be modified somewhat, although the qualitative conclusions of these studies are not altered by this change in the diffusion coefficient of carbon.

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