

of the polycrystalline samples mechanism as that within the that an immediate explanation ential grain-boundary diffusion

was observed in grain-boundary at the trace impurities giving anancies were repelled from the these impurity ions associated boundary regions so that they alous vacancy concentrations distribute themselves randomly after suggestion also offers an ionic diffusion should be lumina in the present pressure-temperatures below 1400°C, might be expected. The alumina re-sintering are likely to contain dislocations because of the re subjected, and if association trace-impurity ions and dislain why intrinsic diffusion can temperatures.

The present section imply that the measurements of Oishi and al specimens (Figure 4, plot G) s 1 diffusion at temperatures d extrinsic class 2 diffusion at hough some samples exhibited our at temperatures as low as cular, samples annealed in air on coefficients were measured at ow about 1650°C) gave results ic class 1 behaviour (i.e. the al.mole⁻¹ plot). It might not be mples should exhibit both types (according to the temperature e of intrinsic diffusion, but it is les contained different types of rise to both cation and anion concentrations. If this is so, the t temperatures above 1650 C. n of cation vacancies controlled , while the impurity-controlled vacancies could be ignored at s the temperature was reduced it would appear that the onancies was prevented from falling y the presence of the appropriate extrinsic class 2 diffusion was at annealing at high temperature tion in the concentration of these or their association with lattice ations, so that extrinsic class 1 ded to lower temperatures. The to contain traces of magnesium y cause anion vacancies), silicon n vacancies), and may have conies which were not sought for

plots A and D (for intrinsic oxygen diffusion in pressure-sintering and in Nabarro-Herring creep) indicate that D_M controlled by intrinsic oxygen diffusion is more than an order of magnitude higher than the tracer diffusion coefficient. This may indicate that the (theoretically calculated) geometrical factor in the Nabarro-Herring creep equation is inaccurate, or may be explained by some other inaccuracy in the calculation of plots A and D, or by inaccuracy in the experimental evaluation of tracer coefficients. In view of the range of possible sources of miscalculation, it may be considered that the observed order-of-magnitude agreement is satisfactory.

Comparison of plots A and B (Figure 4) suggests that D_M (and hence sintering rate) was slightly increased by the addition of 0.025% of magnesia, whereas it has usually been noted^{5,14} that magnesia tends to reduce sintering or creep rates. These observations are not incompatible, firstly because the diffusion coefficients represented by plots A and B are claimed to be accurate only to within about half an order of magnitude, and secondly because plot B would be depressed to lower values of diffusion coefficients for greater concentrations of magnesia (from Equation (15)). D_{c2} is inversely proportional to the impurity concentration to the power 3/2).

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a) (where $z_a=2$ and $z_c=-3$).
en diffusion should be a little more
diffusion coefficient. If the higher-
lot F in Figure 4 is accepted as
oxygen diffusion, it is seen that