Viscosity and graphitic carbon weakening of diopside

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Dynamic behaviours of Earth 's plates are strongly dependent on the viscosity of Earth 's upper mantle. Although a trace amount of hydrogen can markedly weaken the upper mantle, the influence of carbon on viscosity of the upper mantle is unknown. Here we report the deformation experiment of diopside, one of the main constituents of the upper mantle. In order to investigate influence of graphite on creep properties of diopside, we prepared graphite-bearing nano-polycrystalline diopside (average grain size $\phi = 0.4 \,\mu$ m). Deformation experiments have been carried out on graphite-bearing nano-polycrystalline diopside in argon gas atmosphere in a uniaxial deformation apparatus. A homogeneous shortening was observed when the graphite-bearing nano-polycrystalline diopside specimen was compressed at 1080 °C and 1060 °C under subsolidus conditions. The stress exponent n=1.08 at 1080 °C suggests that the deformation mechanism of the graphite-bearing nano-polycrystalline diopside is dominated by diffusion creep rather than dislocation creep. Viscosity of the graphite-bearing nano-polycrystalline diopside aggregates. Our results demonstrate that diopside is weakened by a small amount of graphite.

Keywords: diopside, graphite, carbon, viscosity, sinter, nano

