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In-situ observations of fluid inclusion - grain boundary interaction in recrystallizing rock analogue camphor

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Fluid inclusions in mineral grains or at grain boundaries provide fundamental information to help reconstructing the conditions of basin formation and metamorphism. The mobility of fluid inclusions and fluid-rock interaction helps us to characterize the effect of the pore fluid on i) the mechanical properties of the rock and ii) the transport of fluid through a rock volume. We performed see-through deformation experiments on the rock analogue camphor in the presence of the fluid phase ethanol to characterize the in-situ pore fluid morphology during static and dynamic grain boundary migration recrystallization. The polycrystalline material was deformed at high homologous temperatures ($T_h \approx 0.7$) and strain rates of 2×10^{-6} to $5 \times 10^{-5} s^{-1}$. For grain boundary migration rates ranging from 10^{-11} to $10^{-6} ms^{-1}$ we observed Zener pinning, the drag and drop of fluid inclusions by migrating grain boundaries but also some instances in which the fluid phase was not affected by moving grain boundaries. We mapped the drag limiting migration rates for the present model materials, which are three times lower for annealing than for dislocation density driven recrystallization. We present a detailed description of fluid inclusion - grain boundary interactions with respect to fluid inclusion size and grain boundary migration rates. The description of the formation of isolated fluid inclusions and fluid inclusion arrays with respect to the fluid inclusion morphology supports established theories on diffusive material transport and surface tension driven instability of fluid inclusions.