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Oxygen isotope heterogeneity in chondrules: an experimental study.

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To test the hypothesis that the ^{16}O heterogeneity of chondrules derives from the continuous exchange of a crystallising melt with surrounding gas [1], we conducted oxygen isotope exchange experiments between a chondrule analogue melt and H_2O -rich gas phases. Parallel runs were equilibrated into a vertical gas mixing furnace using the loop technique. Runs were performed at the temperature of 1500°C from 5 minutes to 24 hours and then quenched into glasses. The $f\text{O}_2$ was kept low by bubbling H_2+N_2 through water. Appropriate $\text{H}_2/\text{H}_2\text{O}$ volume ratios were used to provide different $f\text{O}_2$ values. The charges were used for oxygen isotope study and EMP analyses. The oxygen isotope results reveal that the equilibrium was approached within three hours and that about the 70% of exchange was reached in the first 5 minutes for both the IW-1 and -2 experiments. This suggests that the exchange process is diffusion-controlled and independent on the partial pressure of water. Equilibration of Fe loop with silicate melt was used to check the oxygen fugacity.

[1] Clayton, R.N. et al. (1983) in *Chondrules and their Origins*. Lunar. Planet. Inst., Huston, 37–43.

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