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A systematic for oxygen isotopic composition in meteoritic chondrules.

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Primitive meteorites are characteristically formed from an aggregation of sub-millimeter silicate spherules called chondrules. Chondrules are known to present large three-isotope oxygen variations, much larger than shown by any planetary body. We show here that the systematic of these oxygen isotopic variations results from open-system gas-melt exchanges during the formation of chondrules. We have modeled the oxygen isotopic effects that would result from high-temperature interactions in the disk between precursor silicate dust and a gas enriched in SiO during the partial melting and evaporation of this dust. This formation process predicts: (i) a range of oxygen isotopic composition for bulk chondrules in agreement with that observed in Mg-rich porphyritic chondrules, and (ii) variable oxygen isotopic disequilibrium between chondrule pyroxene and olivine, which can be used as a proxy of the dust enrichment in the chondrule-forming region(s). According to the present model, gas-melt interactions under high $PSiO_{(gas)}$ left strong imprints on the major petrographic, chemical and isotopic characteristics of Mg-rich porphyritic chondrules.

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