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Cassiterite-saturated minimum melting behavior within Sn-SnO_2-SiO_2 at 1 atm and 10 kbar

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Abstract

Anhydrous minimum-melting equilibria saturated with SnO_2 form a pseudo-binary within Sn-SnO_2-SiO_2 close to the join SnO-SiO_2. This relationship, previously observed in various studies at 1 atmosphere and confirmed here, is explored more uniformly across the full compositional range of the system at pressure of ca. 10 kbars using Re capsules. Eutectic points and curves increase significantly in temperature with 10–11.6 kbars of pressure with only modest shifts of eutectic composition from that at ca. 1 bar pressure. No silicate liquid immiscibility was encountered in the minimum-melting regime although it may develop with increasing pressure in SiO_2-rich compositions. Possible configurations for the equilibria at temperatures greater than minimum melting suggest wide fields of Sn-SiO_2 and SnO_2-SiO_2 liquid immiscibility on either side of the SnO-SiO_2 join. The SnO-SiO_2 pseudo-binary involves a trough between the two thermo-compositional immiscibility maxima that reflects the thermal stability and volatility of the SnO dimer and its complexes. In general, these data support high solubility of tin in anhydrous silicate melts, at geologically relevant temperatures and somewhat low oxygen fugacities, as the tin contents of the run products ranged from 24–62 and 51–81 wt%, respectively, for ca. 1 bar and 10 kbar experiments.

Keywords: Cassiterite, tin solubility, phase equilibrium experiments