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LETTER

Experimental confirmation of high-temperature silicate liquid immiscibility in multicomponent ferrobasaltic systems

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ABSTRACT

Here we report the results of an experimental study aimed at testing the existence of stable, super-liquidus immiscibility between silica- and Fe-rich multicomponent melts at temperatures above 1100 °C. Four pairs of the potentially immiscible compositions were tested in a 1-atm gas-mixing furnace (Ar/H_2-CO_2 gas mixture) at 1150 and 1200 °C and at the oxygen fugacity corresponding to that of the QFM buffer. Pre-synthesized pairs of the silica-rich and Fe-rich starting compositions were loaded in Pt wire loops, fused separately at 1300 °C, then brought in contact and kept at constant experimental temperature for more than 24 h. Three pairs of compositions out of four used in this study did not mix. Some temperature-dependent chemical re-equilibration was observed in the Fe-rich liquid phase but, in the cases of immiscibility, the two liquids remained compositionally distinct and showed sharp compositional gradients at contacts. One pair of liquids crystallized some tridymite, whereas the other compositions were clearly above the liquidus. Overall, the results of the experiments are in good agreement with the earlier centrifuge study and confirm the existence of stable, super-liquidus immiscibility in some Fe-rich basaltic-andesitic compositions at temperatures up to 1200 °C.

Keywords: Experimental petrology; silicate liquid immiscibility; ferrobasaltic; multicomponent silicate melts