

Loss of Iron

The systems investigated in this study contained FeO and TiO₂ in order to reflect the composition of natural rhyolitic melts. EMPA measurements of the starting glasses from crystallization experiments, however, show considerable variations in FeO contents for starting materials with identical initial FeO concentrations. The HYS glasses, designed to contain 2.5 wt.% FeO, were found to contain an average of 2.06 wt.% FeO ($1\sigma = 0.28$ wt.%), corresponding to a loss of ~ 20 %. For the HYW glasses that were designed to contain 1 wt.% of FeO the problem appears to have been minimal, with glasses retaining an average FeO content of 1.01 wt.%. It was also noted that FeO contents may vary significantly within an investigated sample. For example, HYS24, which was designed to contain ~2.5 wt.% FeO, contained an average FeO content of 1.75 wt.% with an unusually high standard deviation of 0.39 wt.% (see Appendix Table 1).

Alloying between Fe in the rhyolitic charge and Pd of the capsules is most probably responsible for this drop in FeO content (Barr & Grove, 2010). The reason for the difference in Fe loss between the HYS and HYW group starting glasses could be related to either differences in the overall a_{Fe} or differences in the $\text{Fe}^{2+}/\text{Fe}_{\text{total}}$ ratio. The $\text{Fe}^{2+}/\text{Fe}_{\text{total}}$ ratio calculated using the model of Kress & Carmichael (1991) is ~ 0.8 – 0.9 for HYS glasses and ~ 0.7 for HYW glasses. We assume that the FeO depletion is a function of the distance to the capsule material. As the fragments of the run products used for preparation (polished thin section) were randomly picked, the initial position in the capsule and especially the distance from the sample container is not known and no systematic correction is possible. Therefore variations in FeO content cannot be used to investigate the crystallization of Fe-bearing phases because of the overlying influence of alloying.

The FeO content of glasses from experimental products was further reduced. Samples originating from the HYS starting glasses contain an average of 1.58 wt.% FeO (an average additional loss of 23%) in the glass and samples originating from the HYW starting glasses

contain an average of 0.84 wt.% FeO (17% loss) in the glass. However, whether this further loss of Fe can be attributed to the influence of alloying or the crystallization of magnetite cannot be resolved.