Potential-pH diagram for the vanadium-water system at high vanadium concentration

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Introduction

Vanadium can form different species in aqueous solution. The various species of vanadium in aqueous solution depend on the pH value and potential of solution, the total concentration of vanadium, and the kinds of coexistent salts. Previous papers have reported the thermodynamics of vanadium-water system at $C_{T (V)} = 1.0 \times 10^{-7} \sim 1.0 \times 10^{-3}$ mol·L^{-1}. This paper presented the potential-pH diagram of vanadium-water system at higher total vanadium concentration.

Discussion of Results

The potential-pH diagram for the vanadium-H_2O system with $C_{T (V)} = 0.1$ mol·L^{-1} at 298 K was shown in Figure 1. At higher potential regions, the multi-core vanadium radical anions take the absolutely advantage position in solution and produce predominance areas of vanadium (V) peroxide ions $VO_2 \cdot H_2O_2^+$ and $VO \cdot H_2O_2^{3+}$. Comparisons between the predominance diagrams for the vanadium-H_2O system at $C_{T (V)} = 1.0 \times 10^{-7} \sim 1.0 \times 10^{-3}$ mol·L^{-1} [1, 2] and $C_{T (V)} = 0.1$ mol·L^{-1} show that in more concentrated solutions, the predominance area of V^{3+} spreads to weakly oxidation region, and the predominance areas of VOH^{2+} and VO^+ ions slightly reduce in the direction of negative potential, whereas the borderlines of the predominance areas of V^{3+}, VOH^{2+} and VO^+ have no changes with the changes on pH.
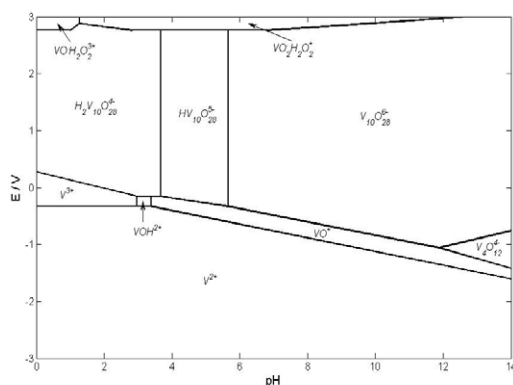

Figure 1: Predominance diagram of V-H_2O system at $C_{T(V)} = 0.1$ mol.L^{-1}

Accurate phase volume ratio determination of crystal-rich inclusions by focused ion beam milling and microanalysis

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An initial and crucial step in the petrographic analysis and interpretation of melt inclusions in plutonic rocks is the assessment of phase relations [1]. Despite the importance of this step for evaluating the suitability of inclusions for subsequent microthermometric and chemical analyses, most previous melt inclusion studies rely on qualitative estimates of phase volume ratios obtained using optical microscopy. Such optical estimates are especially imprecise for typical melt inclusions that contain dark masses of crystals ± glass and aqueous fluid, and are on average 10 μm in diameter [2]. In the present study a LEO (Zeiss) 1540XB FIB/SEM has been used to improve the measurement of phase volume ratios in selected individual crystal-rich inclusions belonging to a melt or fluid inclusion assemblage. The LEO 1540XB instrument offers focussed ion beam milling and simultaneous high-resolution SEM imaging with energy dispersive x-ray analysis. Three dimensional microtextural and elemental analysis was achieved by milling laterally through a single crystal-rich inclusion. Identification of different solids encountered during milling was facilitated by energy dispersive microbeam analysis. Secondary and backscattered electron images and elemental maps were obtained from serial cross sections at different lateral positions in the inclusion. Phase volume ratios were then calculated from these sections by intergrating the areas of the inclusion and contained solid phases. Examples of the measured phase ratios of crystal-rich inclusions from rare-element granitic pegmatites will be discussed.

[1] Bodnar & Student (2006) *Mineralogical Association of Canada Short Course Volume Series* **36**, 1–25. [2] Thomas *et al*. (2006) *Mineralogical Association of Canada Short Course Volume Series* **36**, 189–210.