American Mineralogist, Volume 92, pages 1238–1241, 2007

LETTER

Valence state partitioning of Cr and V between pyroxene-melt: Estimates of oxygen fugacity for martian basalt QUE 94201

J.M. KARNER,[1,*] J.J. PAPIKE,[1] C.K. SHEARER,[1] G. MCKAY,[2] L. LE,[3] AND P. BURGER[1]

[1]Astromaterials Institute, Department of Earth and Planetary Sciences, University of New Mexico, Albuquerque, New Mexico 87131, U.S.A.
[2]Mail Code ST, NASA JSC, Houston, Texas, 77058, U.S.A.
[3]ESC Group, JE23, Houston, Texas, 77058, U.S.A.

ABSTRACT

Based on the partitioning of Cr and V between pigeonite cores and bulk composition, we estimate that martian basalt QUE 94201 crystallized at an f_{O_2} between IW+0.2 and IW+0.9. These estimates are based on calibration curves for D_{Cr}, D_V, and D_{Cr}/D_V (pyroxene/melt) derived from experimental charges that were synthesized at f_{O_2} conditions of IW-1, IW, and IW+1. We believe our f_{O_2} estimate is robust because (1) the f_{O_2} is measured in the earliest crystallizing pyroxenes; (2) the calibration curves are based on the same bulk composition as the natural sample; and (3) that bulk composition represents a melt from the martian mantle, so an accurate D_{Cr} and D_V are measured. Presently, the two best candidates for martian melts, Y 980459 and QUE 94201, indicate an f_{O_2} of IW to IW+1 for the upper martian mantle.

Keywords: Martian meteorites, Vanadium, pyroxene, oxygen fugacity, chromium