

Non-conventional synthesis and magnetic properties of MAX phases (Cr/Mn)₂AlC and (Cr/Fe)₂AlC

Christin M. Hamm,^a Joshua D. Bocarsly,^b Gareth Seward,^c Ulrike I. Kramm^{a,d} and Christina S. Birkel^{a,†}

SUPPLEMENTARY INFORMATION

Details about the electron probe micro analyses:

Operating conditions were 40 degrees takeoff angle, and a beam energy of 15 keV. The beam current was 10 nA, and the beam diameter was 0 microns (fully focused). Elements were acquired using analyzing crystals LLIF for Cr α , Mn α , Fe α , and LTAP for Al α . The standards were Al metal for Al α , Cr metal for Cr α , Mn metal for Mn α , and Fe metal for Fe α . (Cr_{1-x}Fe_x)₂AlC samples were collected using off-peak background correction methods: The on-peak counting time was 40 seconds for all elements. The off peak counting time was 40 seconds for all elements. The off peak correction method was Linear for all elements. (Cr_{1-x}Mn_x)₂AlC samples were collected using Mean Atomic Number (MAN) background correction methods: The on-peak counting time was 30 seconds for all elements. The MAN background intensity data were calibrated and continuum absorption corrected for Al α , Cr α , Mn α (see Donovan and Tingle¹). Element C was calculated by difference from 100% and not directly measured. The matrix correction method was ZAF or Phi-Rho-Z Calculations and the mass absorption coefficients dataset was FFAST according to Chantler *et al.*² The ZAF or Phi-Rho-Z algorithm utilized was Armstrong/Love Scott (see Armstrong³).

The maps were collected at 15 kV and 100 nA beam current. 0.1 s pixel dwell time, 500 x 500 pixels at 1 μ m per pixel.

1. Donovan JJ, Tingle TN. An Improved Mean Atomic Number Background Correction for Quantitative Microanalysis. *J Microsc.* 1996;2:1-7.
2. Chantler C, Olsen T, Dragoset R, et al. X-Ray Form Factor, Attenuation and Scattering Tables. version 2.1; 2005
3. Armstrong J. Quantitative Analysis of Silicate and Oxide Materials: Comparison of Monte Carlo, ZAF, and Phi-Rho-Z Procedures. In: *Microbeam Analysis.* ; 1988:239-246.