PARTITIONING OF CHROMIUM IN THE SYSTEM $MgO–Al_2O_3–SiO_2–Cr_2O_3$ AT 1 atm

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Storage and inertization of toxic wastes containing heavy metals (Cr, Cd, Pb) should be approached by appropriate technological recycling processes. Chromium can be reinserted in a number of crystalline phases forming in the system $MgO–Al_2O_3–SiO_2$, profiting from petrological knowledge at supersolidus conditions. This way a complete bonding of chromium in a refractory phase assemblage and thus inertization can be obtained.

Phase equilibria were investigated in the spinel, corundum and mullite primary phase fields of the system $MgO–Al_2O_3–SiO_2–Cr_2O_3$, aimed to study chromium partitioning between solid and liquid phases, at temperatures up to 1560 °C. Six different bulk compositions were prepared: three of them with SiO_2:Al_2O_3 = 1:1 and three with SiO_2:Al_2O_3 = 2:3. All compositions had Cr_2O_3:Al_2O_3 = 1:9 in molar proportions. A first set of runs was performed in platinum capsules, heated in a vertical furnace with controlled atmosphere, and quenched in water.

Preliminary chemical characterization of the phases by electron probe microanalysis shows strong partitioning of chromium relative to coexisting liquids in spinel, corundum–eskolaite series phases and Cr-mullite, for appropriate bulk compositions. Cr_2O_3 content in mullite coexisting with Cr_2O_3-Al_2O_3 solid solutions in the most Al-Si-rich sample is up to 11 wt%; such amount is very close to the upper limit known of chromium solid solubility in the mullite structure, as reported by RAGER et al. (1990). Cr_2O_3 content in glass ranges from 0.3 to 0.9 wt% and Cr_2O_3 increases with the Al_2O_3 content of the liquid phase, in agreement with previous work by SCHWESSINGER & MUAN (1992). Al_2O_3 partitioning between spinel and coexisting liquids shows a major dependence on the composition of the bulk system, i.e. on the composition of the coexisting phases, as found by SCHWESSINGER & MUAN (1992) in Al-poor systems. Relationships between chromium and aluminum partitioning in spinels, Cr-mullite and glass are discussed.

References

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