

X-ray diffraction phase analyses for granulated and sintered ceramic materials

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Abstrak

One basic problematic aspect in x-ray diffraction phase analysis is microabsorption effect which may arise from the size of the crystallite phases. Complication of the problem may intensify in sintered ceramic materials where milling of the samples is not simple. We report the Rietveld x-ray diffraction phase analysis of MgO- Al_2O_3 powder mixtures with phase content ratio of 1:1 by weight and MgO- Y_2O_3 sintered ceramic composites with Y_2O_3 contents of 10%, 20% and 30% by weight. The mixtures were pre-sintered at 1000°C for 2 hours and then milled while the composites were sintered at 1550°C for 3 hours. The phase composition analysis was done using Rietica, a non-commercial Rietveld method-based software. Relative and absolute phase compositions were examined and results showed that there was a significant amount of phase composition bias resulted from the examination. For the powder mixture, milling can reduce microabsorption effect and hence the calculation bias. For the ceramic composite where milling is almost impossible, additional of Y_2O_3 caused smaller crystallite size of MgO, so that composition bias is smaller in composites with higher Y_2O_3 content. A mathematical model is proposed to provide more acceptable phase composition results.