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Abstract
Terbium aluminum garnet (TAG) was successfully synthesized by a novel solid-state reaction method in this study. Before calcining, the mixing powder of terbium oxide (Tb4O7), boehmite (AlOOH) and cerium chloride (CeCl3 · 7H2O) was pre-aged at pH=1, pH=2 and pH=3, respectively. According to the experimental results, the aged at pH=1 was the best process for the formation of TAG powder. The effects of pH on the formation of TAG powder was studied. Comparing with the traditional solid-state reaction method, the diffusion distances between terbium oxide and boehmite slurry was reduced by only pre-aged the mixed slurry at pH=1. Pure phase TAG powders were obtained after pre treating the aged mixture of boehmite, terbium oxide and cerium chloride at 1200℃ for 2 h and was then calcined at 1500℃ for 20 h. The particle size of the product of pure TAG powders was about 1 μm in diameter with the agglomerate morphology observed by scanning electron microscopy. The TAG powder formed by this method had the higher luminescence efficiency which the maximum emission wavelength was about 553nm as excited at 470 nm.
In the second part of this study, the phase formation processes of Y-TAG solid solution were discussed. As doping Tb3+ to the Y3+ site of YAG lattice, the maximum emission band shifted to a longer wavelength due to larger crystal field splitting. Under 470nm exciting, the maximum emission wavelength shifted from 535nm (YAG) to 553nm (TAG).
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