

Conditions and mechanism for crystal growth of Si-doped AlN powders

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Aluminum nitride (AlN) powder has significant potential as ultraviolet (UV) emitter without rare-earth doping. In our previous study [1], it has been found that Si doping in AlN enhances both UV luminescence (280-380 nm) and affects crystal morphology (Fig. 1).

In this work, we have investigated the crystal growth of Si-doped AlN powders under different growth conditions, using SEM, XRD, cross-sectional CL and EDS measurements. AlN powder was mixed with Si₃N₄ additive (nominal Si concentration was varied from 0 to 4 at%) and synthesized at 1950°C for 2-8 hours. The particle size was measured statically by SE images and typical particle features are shown in Fig. 2. Below 1 % of Si, the crystal growth was hardly occurred. Between 1.6 and 2.4 %, AlN powders grow gradually, where average size increases with certain distributions. This suggests that the growth is related to Ostwald ripening. CL and EDS data indicates that AlN powder has once coated with SiN_x surface layer and the growth proceed. At last, the Si concentration inside AlN powder becomes uniform. More than 4 % Si, however, the growth has been suppressed and SiN_x exists locally in AlN powder.

In summary, 1~3 at.% of Si promotes Ostward ripening growth of AlN particles.

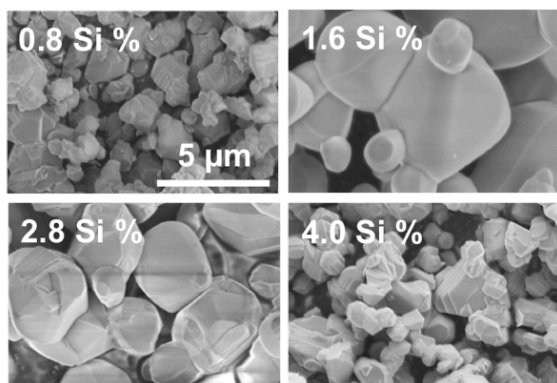


Fig. 1 SEM image of Si-doped AlN with different Si concentration at 4 hours growth time.

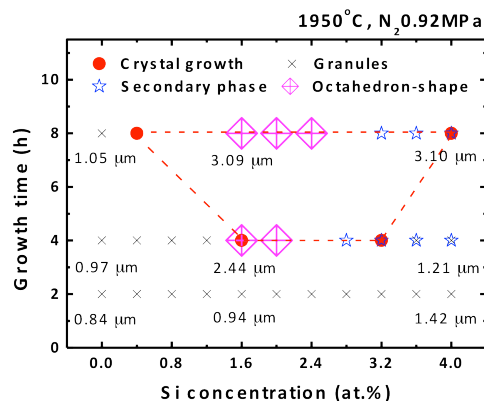


Fig. 2 Crystal growth regions, morphology and average particle size of Si-doped AlN.

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