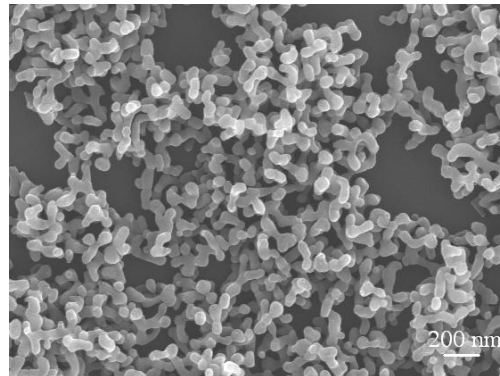


Fiber and Laser Optics

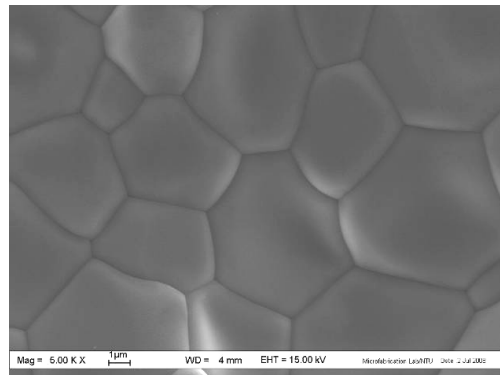
Fabrication of transparent polycrystalline ceramics and ceramic laser gain media – Assoc. Prof. Tang Dingyuan (E-mail: edytang@ntu.edu.sg)

Recent development of nano ceramic material process technology and high temperature vacuum sintering has made available of fabrication of high quality transparent ceramics and ceramic laser gain media. In collaboration with Prof. Ma Jan, School of Material Science and Engineering (MSE), we have developed material process techniques for producing transparent ceramics and successfully fabricated optical transparent YAG ceramic and Nd:YAG ceramic laser gain medium.

In our work high purity, highly reactive and uniform nano-size YAG, Y_2O_3 powders were synthesized. The synthesized powders were then isostatically pressed into pellet, and finally high temperature vacuum sintered into transparent ceramics. Either the solid-state reaction or the coprecipitation methods were used for the high purity nano-sized powder synthesis, and both of the optical transparent YAG, Y_2O_3 ceramics, as well as the Nd:YAG laser ceramic samples were produced. With a thickness of 1.5mm, the optical transparency of our transparent Nd:YAG laser ceramic sample is as high as 82% in the visible range. Furthermore, with our Nd:YAG ceramic samples we have achieved laser emission with a maximum output power of 5W and a slope efficiency of 35%. Currently, we are working on the improvement of the optical quality of our Nd:YAG ceramics. As the further development of the project, we are going to fabricate the composite laser ceramics and the ceramic laser gain media for the mid-infrared solid-state lasers.



SEM images of the Nd:YAG powders from freeze-dried precursor calcined at 1200 °C.



SEM microstructure of the Nd:YAG ceramics after thermal etching.



Photo of a fabricated YAG ceramic sample.