Single crystal growth of Nd-1111 iron pnictide superconductors by high pressure synthesis

A. Takemori a, S. Miyasaka a, b, S. Tajima a, b, S. Lee c, S. Adachi c, N. Chikumoto c, K. Tanabe c

a Dept. of Physics, Grad. School of Science, Osaka Univ., Osaka 560-0043, Japan
b JST-TRIP, Tokyo 102-0076, Japan
c ISTEC-SRL, Tokyo 135-0062, Japan
takemori@tsurugi.phys.sci.osaka-u.ac.jp

In 1111 iron pnictide superconductors, $T_c$ and superconducting gap structure are drastically changed when phosphoros is substituted by arsenic. In previous study, we synthesized polycrystalline samples of PrFeP$_{1-x}$As$_x$O$_{0.9}$F$_{0.1}$ and discussed the different behaviors of transport properties below and above $x \sim 0.6$[1]. For further investigation of superconductivity, we have tried to grow single crystals of the P/As solid solution 1111 system.

The single crystal growth is performed by using high pressure synthesis technique. It has some advantages, such as safe and easy treatment of materials, rapid crystallizing rate, and so on. We could grow single crystals of NdFeAs(O, F) from the mixture pellet of starting materials with the size of $\phi 9 \text{mm} \times 9 \text{mm}$ in BN cell under 3.3GPa at ~1400°C.

A typical crystal size of NdFeAs(O, F) was $0.5 \times 0.5 \times 0.03 \text{ mm}^3$ and $T_c$ was about 40K (Figs.1 and 2). We also synthesized NdFeP$_{0.4}$As$_{0.6}$O single crystals with the size of $\sim 0.5 \text{mm}$.

This work was partially supported by JST, IRON SEA.