§12. Development of the V_3Ga Multifilamentary PIT Wires Using High Ga Content Fine Compounds

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V_3Ga compound superconducting wire will be desirable as a candidate material to realize "low activation and high magnetic field superconducting magnet" for an advanced fusion reactor. Recently, we succeeded in developing new V_3Ga mono-cored and multifilametary wires, fabricated via the Powder In-Tube (PIT) process using the high Ga content compounds including above 50at%Ga composition with the aim of the J_c enhancement by the increase of V_3Ga volume fraction [1-2].

We approached to the fine particle of the high Ga content Cu-Ga compound to in order to improve further Jc property and wire workability. The fine particle of the Cu-Ga compound was made by the jet-milling process. It is well known that the jet-milling was suitable process to get fine particle powder. The each coarse powder was gridded in the Ar jet-stream, and the average particle size of the powder was decreased. Furthermore, the oxidation of the powder was restrained because of the Ar jet-stream.

Fig.1 and Table.1 show the change of the average particle size of the Cu-Ga compound by the jet-milling in Ar atmosphere. This result was the three times of the jet-milling. The average particle size was decreased from 63 μm to 18 μm. We found clearly that the average particle size of the Cu-Ga compound was decreased by the jet-milling process. The fine particle powder of the Cu-Ga compound was packed tightly into a high purity vanadium sheath tube and the precursor mono-cored wires were fabricated through the Powder-In-Tube (PIT) process. Wire drawing was carried out using grooved roller and cassette roller dies. Furthermore, multifilamentary wire was fabricated by cutting the mono-cored precursor wire into 55 short pieces and stacking them into a Ta tube. Typical cross-sectional area of the V_3Ga multifilamentary wire is shown to Fig.2. Fig.3 shows that element distribution of the diffusion layer in the V_3Ga multifilamentary wires using fine particle Cu-Ga compound powder. The thick diffusion layer was formed around interface between V matrix and fine particle powder filament. This was caused by the promotion of the diffusion reaction.

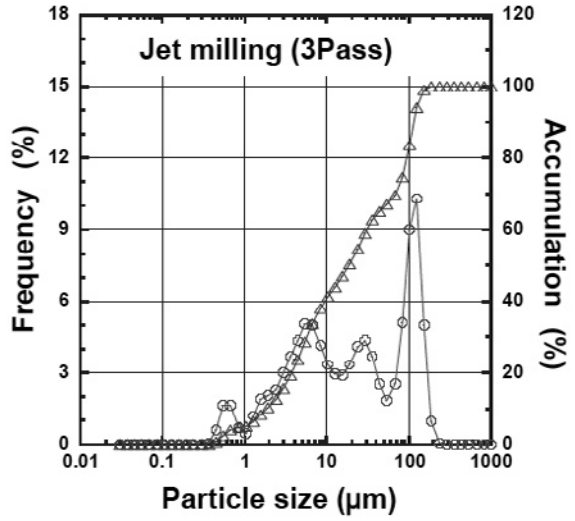

Fig. 1 The particle size distribution of the Cu-Ga compound after the jet-milling (3 times).

Table.1 The particle size comparisons between the hand-milling and jet-milling

	Ave. particle size	Median diameter (50%D)
Hand Milling	63.518	112.145
Jet milling (3 Pass)	16.363	18.639

[1] Y. Hishinuma, et.al, SUST, **20**, (2007), pp.569-573.
[2] Y. Hishinuma, et.al, J. Phys.:Conf. Ser., **97**, 012167

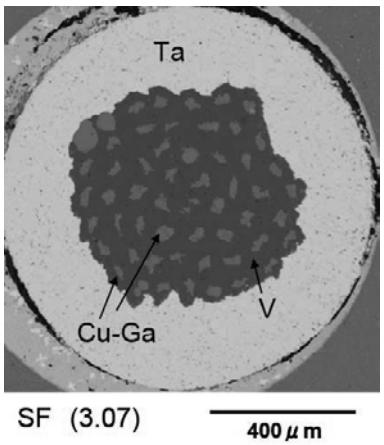

Fig. 2 SEM image of the cross-sectional area of the V_3Ga multifilametary wires using fine particle Cu-Ga compound.

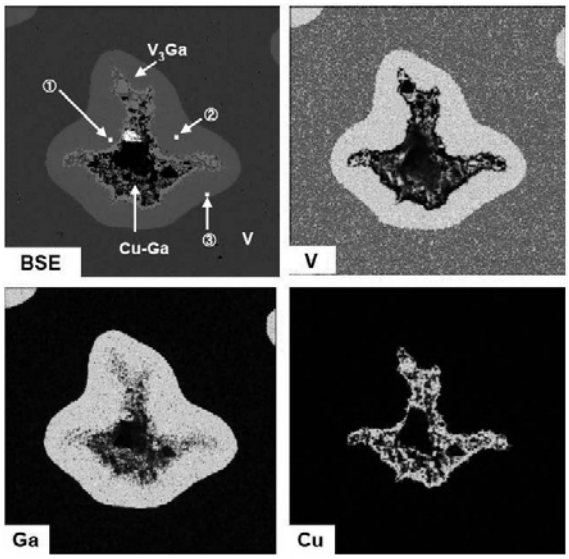

Fig. 3 The element distribution of the cross-sectional area of the V_3Ga multifilametary wires using fine particle Cu-Ga compound.