We carried out scientific research on three traditional techniques, oroshi-gane, orikaeshi-tanren and yaki-ire, inherited by the swordsmiths, HOKKE-Saburo Nobufusa 9th and his son, HOKKE-Eiki, in Miyagi prefecture. The results are as follows:

1. With oroshi-gane technique, adjustment of carbon contents in steel, they can both carburize iron and decarburize cast iron in a same furnace. In each process the different mechanisms are assumed to work in the furnace. In the case of carburizing of iron, solid iron absorb carbon at the upper part of the furnace and it stickily drop down in semi-melted. The wind through tuyere hardly blow in the product at the bottom of the furnace, On the contrary, in the case of decarburizing of cast iron, cast iron melt at the upper and the molten material drip down. It is decarburized at the bottom of the furnace by the wind through tuyere.

2. With orikaeshi-tanren technique, duplicated folding and hammer welding, the carbon content is homogenized in increasing of times of folding. Each inclusion is made smaller and is dispersed uniformly in increasing of times of folding. The temperature of forging is different according to the concentration of carbon in raw material.

3. In yaki-ire technique, quenching, the heating temperature of the nie and nioi, the quenching patterns at the blade, is measured. The temperature of the steel under coating clay is also measured at some intermediate period in quenching process, and it is confirmed that the coating clay have an effect on relatively slow cooling of the ground part.

key words: Japanese sword, swordsmith, refining, decarburizing, carburizing, forging, quenching