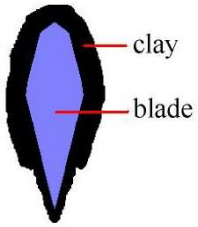
Yakiire (edge hardening) and curvature

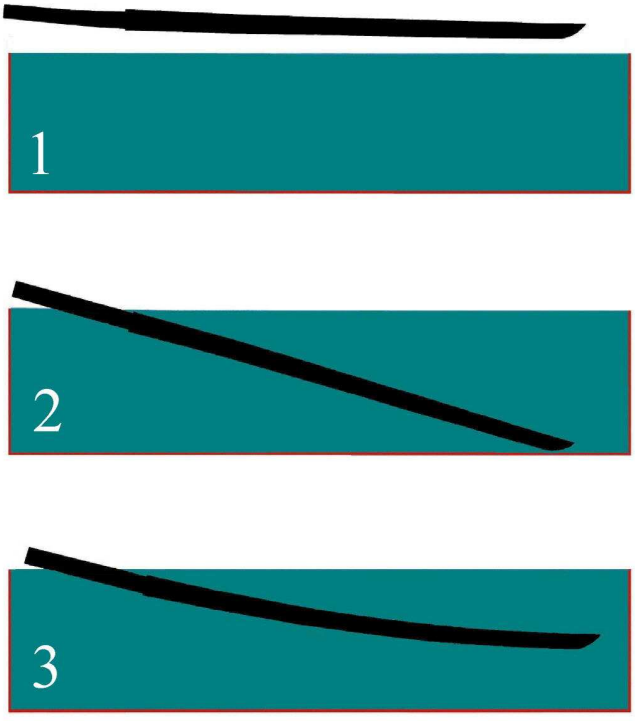
by

C.U. Guido Schiller

1) After forging and final shaping the blade is covered with clay, a thick layer on the body and a thinner layer on the edge where the Yakiba will be. After the clay has dried, the sword is placed in a charcoal fire until the temperature reaches approximately 700°Centigrade (1290°Fahrenheit) on the back and 800°Centigrade (1470°Fahrenheit) on the edge. Due to the heating the blade gains somewhat in dimensions, and the tip curves a little upwards. It is then plunged into a container with water of a temperature of about 20°Centigrade (70°Fahrenheit).



2) In the water the edge, which has a thinner clay coating, cools off faster than the main body of the sword - the thicker clay, together with the greater thickness of the blade itself, keeps the heat longer than in the edge portion. The material at the edge contracts, and two seconds after the swords has been put into the water the blade curves slightly towards the edge; this is called Saka-zori or Gyaku-zori ("reversed Sori").



3) Five seconds after the blade got immersed in water, the rapid cooling of the edge caused a transformation of the steel structure from austentite (a nonmagnetic solid solution) to martensite (a very hard and brittle solid solution of iron and carbon), resulting in an expansion of the edge. The body of the sword, cooling off slower and loosing its expansion which was caused by the heat, crystallizes into pearlite (a mixture of iron and cementite [iron carbide]). In other words: the edge expands while the back shrinks, thus gaining a Sori towards the back, the typical shape of a Nihontô.

sources:
conversations with Takano Yukimitsu 高野行光 and Ohno Yoshimitsu 大野義光
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