WHAT IS CLAIMED IS:

1. A polishing method for a compound semiconductor substrate for polishing the compound semiconductor substrate, comprising:

a holding step of holding the compound semiconductor substrate by a chuck table of a polishing apparatus; and

a polishing step of polishing the compound semiconductor substrate while supplying a polishing liquid from a polishing pad to the compound semiconductor substrate in a state in which the polishing pad, having abrasive grains, is brought into contact with one surface of the compound semiconductor substrate, wherein

the polishing liquid includes an aqueous solution in which a permanganate and a water-soluble compound obtained by combination of a strong acid and a transition metal element are dissolved,

the transition metal element includes at least one element of Group III elements, lanthanoid, or Group IV elements,

concentrations of ammonium ions and ammonia contained in the aqueous solution are equal to or less than concentrations of the Group III elements, the lanthanoid, and the Group IV elements, and

wherein free abrasive grains are not contained in the polishing liquid.

2. The polishing method according to claim 1,

wherein a concentration of the permanganate of the polishing liquid is equal to or more than 0.6 wt%, and a concentration of the water-soluble compound is equal to or more than 0.3 wt%.

3. The polishing method according to claim 1,

wherein a concentration of the permanganate of the polishing liquid is equal to or less than 4.8 wt%, and a concentration of the water-soluble compound is equal to or less than 2.4 wt%.

4. The polishing method according to claim 1,

wherein the one surface is directed upward and the polishing liquid is supplied from above the compound semiconductor substrate.

5. The polishing method of any one of claims 1 to 4, wherein, in the polishing step, the chuck table is moved in an X-axis direction within a predetermined distance.