CLAIMS

1. A method of polishing a silicon wafer, comprising a double-side polishing step as a lapping step followed by a final polishing step including:

an upstream polishing step, using an upstream polishing unit including a first plate provided with a first polishing pad on its surface and a first polishing head, of polishing a surface of a silicon wafer by rotating the first plate and the silicon wafer held by the first polishing head while making the silicon wafer in contact with the first polishing pad and supplying a first polishing agent to the first polishing pad; and

a subsequent finish polishing step, using a finish polishing unit including a second plate provided with a second polishing pad on its surface and a second polishing head, of further polishing the surface of the silicon wafer by rotating the second plate and the silicon wafer held by the second polishing head while making the silicon wafer in contact with the second polishing pad and supplying a second polishing agent to the second polishing pad,

wherein in the upstream polishing step, as the first polishing agent, a first alkaline aqueous solution containing abrasive grains with a density of $1 \times 10^{14}/cm^3$ or more is first supplied to perform the polishing at a polishing rate of 100 nm/min to 300 nm/min, and the supply is then switched to a supply of a second alkaline aqueous solution containing a water-soluble polymer and abrasive grains with a density of $5 \times 10^{13}/cm^3$ or less to perform the polishing at a polishing rate of 5 nm/min to 20 nm/min,

after the upstream polishing step, the silicon wafer is detached from the first polishing head and is transferred to the finish polishing unit while supplying water to the surface of the silicon wafer, and the silicon wafer is attached to the second polishing head, and

in the finish polishing step, as the second polishing agent, a third alkaline aqueous solution containing a water-soluble polymer and abrasive grains with a density of $5 \times 10^{13}/cm^3$ or less is supplied to perform the polishing at a polishing rate of 5 nm/min to 20 nm/min.

2. The method of polishing a silicon wafer, according to Claim 1,

wherein in the upstream polishing step, after a lapse of a polishing time in which a target amount of polishing in the step is achieved, the first polishing agent is switched from the first alkaline aqueous solution to the second alkaline aqueous solution.

3. The method of polishing a silicon wafer, according to Claim 1 or 2,

wherein in the upstream polishing step, the second alkaline aqueous solution is supplied for a period of 10 seconds or more.

4. The method of polishing a silicon wafer, according to any one of Claims 1 to 3,

wherein in the finish polishing step, an undiluted alkaline solution containing the water-soluble polymer and the abrasive grains is mixed with pure water in a dilution tank, thereby preparing the third alkaline aqueous solution,

the prepared third alkaline aqueous solution is supplied to the finish polishing unit using a piping system that communicates with the dilution tank, and

before the third alkaline aqueous solution in the dilution tank runs out, the undiluted alkaline solution and the pure water are newly added into the dilution tank to prepare a new portion of the third alkaline aqueous solution.

5. The method of polishing a silicon wafer, according to Claim 4,

wherein the undiluted alkaline solution and the pure water are newly added into the dilution tank while the third alkaline aqueous solution remains to take up 10 % or more of a volume of the dilution tank.

6. The method of polishing a silicon wafer, according to any one of Claims 1 to 5,

wherein in the first to third alkaline aqueous solutions, a mean primary particle diameter of the abrasive grains is in a range of 10 nm to 70 nm.

7. The method of polishing a silicon wafer, according to any one of

Claims 1 to 6,

wherein in the first to third alkaline aqueous solutions, the abrasive grains include SiO_2 particles.

8. The method of polishing a silicon wafer, according to any one of Claims 1 to 7,

wherein the first alkaline aqueous solution contains one or more alkalis selected from potassium hydroxide, sodium hydroxide, tetramethylammonium hydroxide, and tetraethylammonium hydroxide, and

the second and third alkaline aqueous solutions contain ammonia.

9. The method of polishing a silicon wafer, according to any one of Claims 1 to 8,

wherein in the second and third alkaline aqueous solutions, the water-soluble polymer is one or more selected from hydroxyethyl cellulose, polyethylene glycol, and polypropylene glycol.