WHAT IS CLAIMED IS:

1. A large-size diesel exhaust valve, comprising an exhaust valve disc portion made of an alloy comprising the following essential elements in mass percentages: Cr: 39% to 41%, Al: 3.3% to 3.5%, Fe: less than or equal to 0.5%, Ce: 0.1% to 0.2%, Si: less than or equal to 0.2%, Mn: less than or equal to 0.10%, S: less than or equal to 0.010%, P: less than or equal to 0.010%, C: less than or equal to 0.03%, and Ni: the balance, wherein the large-size diesel exhaust valve has the following microstructure: there are ultra-fine grains with a grain size of 10 grade or more, α-Cr lamellar phases are evenly distributed at grain boundaries of the ultra-fine grains, nickel-lean Cr-Al-Ce particle phases are evenly distributed in a matrix, a single lamella of the α-Cr lamellar phases has a thickness of less than 140 nm, and the nickel-lean Cr-Al-Ce particle phases have a diameter of no more than 10 μm.

2. The large-size diesel exhaust valve according to claim 1, wherein the alloy comprises the following essential elements in mass percentages: Cr: 39.2%, Al: 3.32%, Fe: 0.12%, Ce: 0.2%, Si: 0.03%, Mn: 0.10%, S: 0.010%, P: 0.0033%, C: 0.018%, and Ni: the balance.

3. The large-size diesel exhaust valve according to claim 1, wherein the alloy comprises the following essential elements in mass percentages: Cr: 39.56%, Al: 3.39%, Fe: 0.14%, Ce: 0.12%, Si: 0.061%, Mn: 0.010%, S: 0.003%, P: 0.006%, C: 0.022%, and Ni: the balance.

4. The large-size diesel exhaust valve according to claim 1, wherein the alloy comprises the following essential elements in mass percentages: Cr: 39.23%, Al: 3.35%, Fe: 0.26%, Ce: 0.15%, Si: 0.061%, Mn: 0.010%, S: 0.002%, P: 0.005%, C: 0.015%, and Ni: the balance.

5. A manufacturing method of a large-size diesel exhaust valve, comprising the following steps:

pretreatment: subjecting an alloy bar comprising the following essential elements in mass percentages: Cr: 39% to 41%, Al: 3.3% to 3.5%, Fe: less than or equal to 0.5%, Ce: 0.1% to 0.2%, Si: less than or equal to 0.2%, Mn: less than or equal to 0.10%, S: less than or equal to 0.010%, P: less than or equal to 0.010%, C: less than or equal to 0.03%, and Ni: the balance to a solution treatment at 1,000°C to 1,050°C for 50 min to 70 min to obtain a first intermediate material, and oil-cooling the first intermediate material to obtain a second intermediate material, wherein a thickness of a single lamella of a α-Cr lamellar phase is controlled at less than 150 nm and a diameter of a nickel-lean Cr-Al-Ce particle phase is controlled at no more than 10 μm;

electric upsetting process: forming the second intermediate material through electric upsetting at a low strain rate to obtain a first billet, wherein throughout the electric upsetting process, an electric

upsetting temperature is controlled at 1,150°C to 950°C and an electric upsetting strain rate is controlled at 0 s^{-1} to 0.05 s^{-1};

supplemental heating treatment: conducting supplemental heating on a head of the first billet at 1,000°C to 1,050°C for 20 min to 25 min to obtain a second billet;

heat preservation treatment: holding the second billet at 1,000°C to 1,050°C for 20 min to 25 min to obtain a third billet, wherein a total time of a supplemental heating time and a heat preservation time is 45 min or less;

die forging process: forging the third billet at one time to produce a first initial exhaust valve with a disc portion and a rod portion; and

post-treatment: subjecting the first initial exhaust valve to an aging treatment at 770°C to 790°C for 16 h to 18 h to obtain a second initial exhaust valve, and air-cooling the second initial exhaust valve,

wherein the thickness of the single lamella of the α-Cr lamellar phase is controlled at less than 140 nm and the diameter of the nickel-lean Cr-Al-Ce particle phase is controlled at no more than 10 μm.

6. The manufacturing method of a large-size diesel exhaust valve according to claim 5, wherein the aging treatment is conducted at 780°C.

7. The manufacturing method of a large-size diesel exhaust valve according to claim 5, wherein the solution treatment in pretreatment is conducted at 1,020°C for 60 min.

8. The manufacturing method of a large-size diesel exhaust valve according to claim 5, wherein the supplemental heating treatment is conducted at 1,020°C for 20 min; and the heat preservation treatment is conducted at 1,050°C for 25 min.